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EDITORIAL

Palm Oil for Edible Purposes.

Hitherto, palm oil has found its most extended use in the manufacture of soap and candles. As is well-known, the great source of supply of this oil was the West Coast of Africa where there exist extensive forests of this palm. Palm oil extracted by primitive methods has long been part of the staple diet of the West African native, being employed as an edible and cooking oil.

It is probable that at the time when the great increase in demand for edible oils took place, the claim of palm oil in this connection was overlooked on account of the fact that available supplies from Africa were of low quality, the acidity being anything up to 50 per cent. At that time, methods of refining oil were less developed than at present and the manufacturer of edible oil products had, perforce, to look elsewhere for his raw material. This he found in a number of vegetable oils, and in addition whale oil.

The edible oil market was established before the advent of plantation palm oil. Consequently, palm oil, although of high quality, has not yet found any extensive use for edible purposes, a fact which will probably react unfavourably on the plantation industry in a few years time when the quantity of such oil will have assumed large proportions.

The infant industry, if such we may designate palm oil for edible purposes, has, therefore, to overcome the prejudices of the manufacturer, who has adapted his factory methods to the use of other oils, and also the prejudices of the consumer who sees, or thinks he does, objectionable features in palm oil for edible purposes.

It has been stated that the use of plantation palm oil for cooking purposes, without purification, results in digestive troubles. Malays, Chinese and others who have tried it in the "raw" condition have also objected to it on the score that it gave the food an unpleasant taint. On the other hand, we know of an occasion when plantation palm oil, without preliminary treatment, was used for cooking purposes for one week at a Camp, and the men, Malays, Chinese, Indians and Eurasians made no complaint, presumably because they did not detect any unpleasantness.

The utilisation of palm oil for edible purposes is a factor of some importance in Malaya at the present time, when it is desirable to encourage local industries

and at the same time to satisfy the Asiatic demand for a cheap and good edible oil.

The normal Malayan annual demand for oils and fats for cooking amounts to about 12,000 tons of groundnut oil and 8,000 tons of groundnuts, together valued at about \$5,000,000, and about 1,000 tons of ghee valued at about \$1,000,000. In addition, a large quantity of coconut oil is used, but this is supplied by local production.

In an article in this number, entitled "Bleaching of Palm Oil", Messrs. Georgi and Gunn Lay Teik discuss the methods of bleaching the oil and point to the possibilities of its use locally for edible or soap-making purposes.

Without, therefore, considering the export of palm oil for edible purposes, there does appear to be an opening for the marketing of palm oil for consumption in Malaya.

In order to achieve success in this direction it is essential that the oil should be of good appearance and that the price at which it is sold retail should be attractive. In view of the reduced spending capacity of the public at the present time, the marketing of a cheap edible palm oil should go far to overcome prejudice against its use.

Tobacco Experiments.

An article was included in this journal recently giving a general account of the cultivation of tobacco in Malaya, based very largely on the experience gained with this crop at the Government Experimental Plantation, Serdang. In the present number we carry the subject a step further by giving some account of the experiments carried out with this crop in Singapore.

Labour for tobacco cultivation is at present cheap and plentiful. The tobacco planter also has the advantage of growing a crop which gives an early monetary return. He is, moreover, at present materially assisted by the import duty on tobacco. In view of the large consumption of tobacco in Malaya and bearing in mind the above advantage, it is easy to arrive at an unbalanced view of the probably favourable result of planting tobacco on a large scale at the present time.

Lest readers should accuse us of misleading optimism we would again point out that the demand for low grade tobacco is easily satisfied and offers no good prospects for the large-scale planter. The results so far achieved with better grade tobacco are encouraging but have not yet reached a stage at which they may be definitely recommended for local planting. In particular, a great deal of investigation awaits the experimenter in connection with the curing of the leaf. It is a problem that cannot be solved altogether by the experience of other countries; it has to be solved in Malaya because of the climatic and other conditions peculiar to this country.

It is hoped that planters who are working on this crop in a private capacity, will present their difficulties to the Department of Agriculture. We trust that the article now published in this journal may be useful in this connection. We would add that it is hoped that the next number will contain the third of this series of articles, dealing with pests, the ever urgent problem in tobacco cultivation.

Original Article.

TOBACCO EXPERIMENTS AT SINGAPORE

BY

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Singapore.*

Introduction.

Recent trials have been conducted with the cultivation of Virginia types of tobacco, with the object of ascertaining what possibilities may exist for replacing, to some extent, the present large foreign imports of cigarette tobacco by a locally grown leaf.

Conditions governing the production of different types of tobacco vary considerably and, in this instance, trials carried out at the Agricultural Station in Singapore under the immediate control of the writer have been confined solely to the Virginia cigarette types which are often referred to as "Yellow Leaf". The success already obtained is sufficient to justify more extensive experiments.

It is only possible, at present, to deal with production from the sowing period up to and including harvesting operations. Sufficient information is not yet available on which to base any definite recommendations for curing. It has been found, however, that air curing is impracticable under local climatic conditions.

Attempts have been made to cure a few leaves by the application of artificial heat. The results have been encouraging and indicate that it may be possible to produce a marketable leaf by the introduction of a method of flue curing.

Soils.

The soil at the Singapore Station is of a quartzite formation and is in an extremely poor state of fertility, having previously been under neglected pineapple and rubber cultivation. In spite of this condition, some promising results have been obtained after the application of suitable fertilisers.

Climate.

Climatic conditions represent one of the principal problems which have to be faced in Malaya. The quality of Virginia leaf is largely governed by rainfall, but by careful selection of planting dates it may be found possible during normal seasons at least, to avoid the most adverse conditions.

Excessive rainfall during the growing period, more especially towards the latter stage, was found to result in a leaf lacking both in body and in oil. In addition the damage caused by leaf spotting fungi was found to be greater during a wet than during a dry period.

The most suitable planting dates for the island of Singapore range between the end of January to about the middle of March. Planting between these dates will enable the harvest to be reaped by the end of July, which is usually a dry month.

Preparation of Nurseries.

The nursery beds were prepared in the manner described in the November number of this journal on page 562 and were shaded with cheese cloth.

Fertilising the Nursery.

A suitable fertilising mixture has been found to be one containing 6 per cent. of ammonia as ammonium sulphate, 10 per cent. phosphate as super-phosphate and 8 per cent. of potash as potassium sulphate. This mixture was applied at the rate of 4 lbs. to every 10 square yards of nursery planted and was gently raked in just before the sowing of the seed.

Improved growth from weakly seedlings has been obtained by watering them with a weak solution of nitrate of soda at the rate of one half pound to 8 gallons of water per 10 square yards of bed. Immediately after this application the beds were thoroughly watered to prevent injury to the young leaves by direct contact with the nitrate of soda.

Transplanting.

The land to which the young seedlings were to be transferred was marked out in rows 3 feet 6 inches apart and half the intended dressing of fertiliser was applied along these rows three or four days before transplanting commenced. The seedlings were transplanted in the manner described elsewhere during the cool of the afternoon and were spaced 2 feet 6 inches apart in the rows. The seedlings remaining in the nurseries were watered with a weak solution of nitrate of soda as described above and kept for use as supplies. The second half of the fertiliser dressing was applied by sprinkling round the base of the plants three weeks after transplanting.

Harvesting.

Some ninety to a hundred days after transplanting the leaf was ready for harvesting. This condition was denoted by a tendency of the leaf to a slightly mottled yellowish appearance. Furthermore, the midrib of the leaf at the tip snapped clean when bent between the thumb and forefinger. Ripening commences from the base of the plant and two to four of the bottom leaves were removed from each plant as they ripened. Harvesting was undertaken at intervals of three to four days until the whole of the crop was collected.

Immediately after harvesting the leaf was taken to the barn in small bulks, allowing as little exposure to the sun as possible. On arrival at the barn the leaves were strung back to back on sticks and the curing stage commenced.



TOBACCO PLANT AFTER TOPPING.



TOBACCO NURSERIES.



TOBACCO PLANTS : UNFERTILISED.



TOBACCO PLANTS : FERTILISED.

Curing.

Owing to unfavourable climatic conditions in Singapore it has been found impossible to obtain a satisfactory air cure, more especially as the local climatic conditions are exactly those which favour the bacterial infection known in the industry as "Pole Burn". It appears therefore, that the introduction of flue curing will be necessary in order to overcome the difficulties presented by local atmospheric conditions.

Fertilising.

Small fertiliser trials have been conducted. It is not possible to draw any final conclusions from returns from one small set of experiments, but the results gives some indication of the lines to be followed in future trials.

When selecting the ingredients for a fertiliser it is important to provide the nitrogen in a suitable form and to use potassium sulphate to supply the potash in preference to muriate of potash or kainit.

Successful returns have been obtained from a fertiliser mixture containing 6 per cent. ammonia, 10 per cent. phosphate and 8 per cent. potash in the form of ammonium sulphate, super-phosphate and potassium sulphate respectively. Three rates of application were put down, plots being treated with 600 lbs., 800 lbs. and 1,000 lbs. per acre respectively; half of each of these amounts was applied to individual plots three days before transplanting, and the remaining half three weeks later. Growth in each case was satisfactory, but for poor and medium soils 600 lbs. to 800 lbs. per acre of the mixture should result in good returns; any excess quantity appears to be both wasteful and unnecessary.

Yields from the 600 lbs. and 800 lbs. plots ranged from 6,000 lbs. to 7,500 lbs. of green leaf per acre. equivalent to approximately 900 lbs. and 1,100 lbs. of cured leaf. No increased yields were obtained from the higher applications.

The use of cattle manure applied three months before transplanting at rates varying from 10 to 20 tons per acre, all yielded negative results, growth showing very little improvement on that of the plants on the control plots. It is, however, curious to record that plots treated with a mixture containing 6 per cent. ammonia, 10 per cent. phosphate and 8 per cent. potash applied at rates varying from 600 lbs. to 800 lbs. per acre also yielded negative results. In this instance, however, a portion of the nitrogen supplied was in an organic form, the complete mixture being applied one half just before planting and the remainder three weeks later. It is considered possible that had the organic nitrogen been applied some time previous to planting results might have proved more successful. Further experiments in the use of organic forms of nitrogen are required.

A further set of plots was laid down and treated with cattle manure at rates varying from 10 to 20 tons per acre with the addition of 400 lbs. of the complete inorganic fertiliser described above. The resulting growth in all cases was entirely satisfactory, but cattle manure in large quantities is expensive owing to heavy transport charges and the usually poor quality of local supplies. In these experiments the dressings of cattle manure were made three months before transplanting.

Pests.

The Bud Worm (*Heliothis flavigera*) caused damage during the earlier growing period after transplanting. As a control measure dusting with a mixture of one part lead arsenate powder to 100 parts of tapioca flour combined with hand picking of the caterpillars was found to be satisfactory. During dry weather one application of the dusting powder in every three or four days was sufficient, but if rain intervened re-dusting was necessary. In the nursery, hand picking was carried out during the earlier stages, but was substituted by spraying with a mixture of one pound of lead arsenate powder or two pounds of paste in 50 gallons of water.

The caterpillars, (*Agrotis ypsilon* and *Prodenia litura*) caused some damage by attacking plants just below or at ground level. The damage occurred during the night; in the day time the caterpillars lie concealed just below the surface soil at the base of the plants. These pests were controlled by searching for and destroying the caterpillars.

The stem borer (*Phthorimaca heliopa*) was probably one of the most destructive pests encountered, attacked plants being invariably killed. This pest entered just above the crown and bored into the stem. All infected plants were removed and destroyed.

Various grass hoppers at times caused leaf damage. Dusting the entire plant when the dew was on the leaf with the lead arsenate and tapioca flour mixture described above usually proved an effective measure of control.

Diseases.

"Frog Eye" spot caused by *Cercospora nicotiana* attacked the leaves of plants both in the nursery and in the field. This disease appeared first on the bottom leaves of plants in the nursery. Since strong healthy plants are always more disease resistant, nursery beds in which the seedlings showed any weakness or failure to make normal growth were watered with a solution of nitrate of soda at the rate of one half pound to 8 gallons of water. The beds were also sprayed with Bodeaux Mixture. In the field, removal of infected leaves at an early stage was found to assist in preventing further spread.

"Damping Off", possibly caused by *Rhizoctonia solani*, also appeared in the nurseries. To overcome it the plants were watered with nitrate of soda and care was taken to avoid excessive watering since the spread of the disease is encouraged by the presence of weakly plants and of excess soil moisture.

Alternaria spot caused by *Alternaria tabacina* a fungus disease similar in appearance to "Frog Eye," but revealing larger spots and appearing on the stem as well as the leaves, was also thought to be present on older plants in the field. No confirmation of this was actually obtained, but it is undoubtedly a disease which would be encouraged by local conditions.

Wilt or slime disease caused by *Bacillus solanacearum* attacked some plants at the Station, conditions most favourable for its appearance being warm wet weather and damp soil conditions. The only known method of control is by means of crop rotation.

Individual plants exhibiting curling and distortion of the leaves, sometimes coupled with stunting of the plants, were also found at the Station. Symptoms of this nature have been described under the terms Trenching, Crinkling and Leaf Curl but each of these terms cannot yet be considered as indicating a definite disease, since each is often applied in different localities to differing groups symptoms of which the cause in some cases is as yet obscure.

Marketing.

There exists a fairly considerable potential market for a suitable locally grown cigarette leaf to replace to some extent the existing large imports of foreign leaf, but it must be realised that for sale in this market local leaf must conform to the standard of quality required by the buyers.

Conclusion.

These experiments in the cultivation of Virginia tobacco have revealed favourable possibilities, but curing must be further investigated before any definite conclusions can be drawn as to the quality or market value of the leaf which can be produced. The results obtained in these cultivation experiments justify the undertaking of experiments with flue curing.

**SOME PRELIMINARY OBSERVATIONS
ON
THE COFFEE BERRY BEETLE BORER,
STEPHANODERES (CRYPHALUS) HAMPEI Ferr.**

BY

G. H. CORBETT,
Government Entomologist.

Introduction.

This Scolytid beetle is an introduction into Malaya and is an important enemy to the coffee berry in this as well as in other countries. It was first discovered in Selangor in January, 1929, when an immediate survey of the coffee areas indicated that it was generally distributed and had for sometime been present in Malaya. The manner of its introduction and the date of its importation are uncertain but it seems probable that it was conveyed either from Java or Sumatra in consignments of seeds for planting purposes. Its original home is Angola from whence it has spread in Africa to Uganda, Tanganyika and Kenya (1929). Its presence in Nyasaland and Rhodesia has not been recorded. It was imported from Africa into Java about 1909, and from there introduced into Borneo and Sumatra probably about 1919, and into the Brazilian State of S. Paulo in 1924. It was reported in South India in 1930, but subsequently the beetle was identified as *Stephanoderes uniserialatus* Egg. Its presence in the West Indies has been reported and in Europe in coffee beans for consumption. In Malaya, it is not present in all coffee areas, Cameron Highlands, for instance, being free, and every endeavour should be made to prevent its introduction into these areas.

A General Description of the Stages.

THE BEETLE. (Figs. 4 and 6).

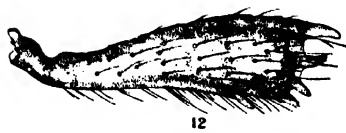
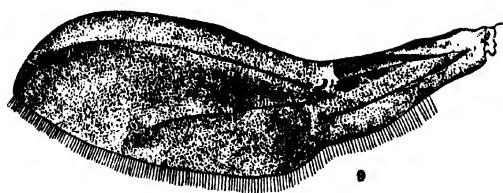
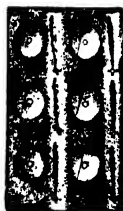
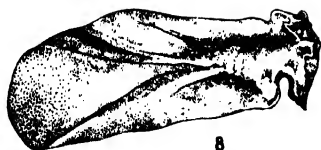
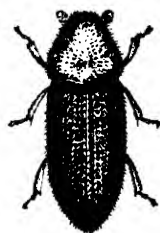
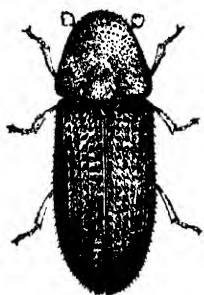
The beetle in appearance is somewhat shining and in colour dark brownish black to black with antennae and legs brown. Female, length about 1.58 mm. and breadth 0.77 mm.; male, length 0.99 mm. and breadth 0.53 mm. The body is cylindrical and uniformly covered with pubescence. The head is rounded and concealed from above by the pronotum. The antennae are about 0.53 mm. in length, the scape (the basal joint) about equal in length to the funiculus and the club together. The pronotum prominent, about half the length of the elytra and covered with small tubercles, which anteriorly are larger and more numerous. The margins of the elytra are parallel. They have their apices rounded and generally cover the pygidium. Sub-circular discs line the nine depressed rows on each elytron and short, broad, feathery scale-like hairs are placed on the shiny longitudinal elevations between these rows. The tibiae are toothed, the

***STEPHANODERES HAMPEI* Ferr.**

EXPLANATION OF PLATE.

1. Eggs. 2. The Grub. 3. The Pupa.
4. The Female and 6. The Male beetle.
5. An Antenna.
7. A Part of Wing Cover.
8. The Male and 9. The Female Wing.
10. The Tibia of first, 11. of second and 12. of
third pair of legs of the beetle, showing the arrangement of
the teeth.

(All much enlarged).



tibia of the first pair of legs generally with six (sometimes seven), of the second pair five and of the third four teeth, in addition to the prominent apical tooth. Four segments of the abdomen are visible ventrally of which the first is equal in length to the second and third together.

The male is readily separated from the female by its small size : other minor differences in the sexes occur.

THE EGG. (Fig 1.)

The egg is milky white, somewhat shining, elongate elliptical, rounded at both ends, slightly constricted in the middle, about 0.59 mm. in length and 0.28 mm. in breadth.

THE LARVA. (Fig 2.)

The young larva on emergence from the egg is about 0.84 mm. in length and anteriorly 0.25 in breadth, narrowing posteriorly. It is white, translucent with the head pale brown, mandibles brown and without legs. Its body is conspicuously clothed with white fine hairs. The full-grown larva is markedly curved, has shorter hairs than the young larva and is about 2.10 mm. in length and 0.80 mm. in breadth.

THE PUPA. (Fig 3.)

The pupa is white, about 1.9 mm. in length and 0.74 mm. in breadth. Its head is completely concealed beneath the pronotum. About ten projections, each with a white hair, arm the margin of the pronotum. The anal segment has two inconspicuous whitish transparent projections. The wing covers extend ventrally to about 0.40 mm. from the termination of the abdomen.

Economic Importance.

The beetle for the most part bores into the green berry for feeding and into the ripe berry for breeding purposes. Slightly bored green berries, in close proximity to each other, are frequently observed without a beetle, indicating that they have all been bored by the same beetle, which has left one and migrated to another berry. By this method of attack, the bored unripe berries are exposed to fungoid enemies, resulting in the formation of black berries which fail to reach maturity. Such berries generally drop but frequently large numbers remain on the bushes. A considerable reduction of crop is occasioned in this manner, as is demonstrated by the following. Six bushes, from which bored green and ripe berries were collected weekly from the time of flowering to the harvesting of the ripe berry, supplied the following figures :--

Bored green berries	...	2085
Bored ripe berries	...	337
Unbored ripe berries	...	2236

In order to ascertain the reduction in the yield of beans over an area with fifty per cent. of the ripe berries bored, a collection of 500 unbored and 500

bored ripe berries from the same coffee bushes was examined. The unbored berries weighed 472.5 grams and the bored berries 468 grams—a difference of only 4.5 grams. From the unbored berries 938,* and from the bored berries only 453 sound beans were obtained. If the figure 938 be considered as representing the normal number of beans which are generally obtained from 500 unbored ripe berries, the reduction in crop in an area with a fifty per cent. of berry infestation would be in the region of twenty six per cent. In this percentage, the loss due to the damage of green berries, which is at times very high, is not included; if this were considered, the reduction in moderately infested areas would probably be in the neighbourhood of fifty per cent. In addition to this reduction in yield, the cost of harvesting and of treating worthless berries should not be overlooked.

It will be seen, therefore, that an estate with an infestation of fifty per cent. of ripe berries would suffer a direct loss in beans of twenty six per cent., but, where the regular collection of bored green, ripe and fallen berries is not carried out and the treatment of berries neglected, a higher percentage of bored ripe berries may frequently result.

Some Observations on the Life Cycle and Habits of the Beetle.

The female beetle bores into the coffee berry generally through the nipple, occasionally through the side and rarely near its attachment to the stalk. One entrance hole through the nipple is generally seen, but sometimes two or three are evident. The green berry is favoured for feeding and the ripe berry for breeding purposes. The degree of hardness of the bean determines the beetle's preference for egg-laying, the riper the berry, the more it is favoured for this purpose. The female beetle has been found in Malaya to live without food for 81 days and with food for 96 days. Friedrichs records that a female may live for 119 days and Leefmans for 123 days (4 months). The period of life of the female has an important bearing on the subject of control and will be considered later.

During the examination of berries of different ages, *when all green bored and black berries were removed*, no male beetles were obtained from bored green berries when collected weekly, fortnightly, three weekly and four weekly or from ripe berries collected weekly, fortnightly and three weekly or from black berries on the bush collected every three weeks. They were only recorded from ripe berries collected monthly, from black berries on the bush, where the collection had been extended to more than three weeks, and from fallen black berries on the ground. *When the green and black bored berries were not removed*, male beetles as well as male pupae were obtained from ripe berries collected weekly. Female beetles, on the other hand, are always numerous on

* In connection with this figure sixty two beans failed to develop. There may be several causes responsible for this reduction, but the thrips, *Haplothrips* sp., in the coffee flowers is probably one of the responsible agents for this degeneration, either directly by puncturing or indirectly by introducing a pathogenetic organism.

the coffee bushes and within berries of almost any age.

Whilst male beetles have only very rarely been observed to leave a berry, and then apparently when they are about to die, individual females emerge from a berry and fly at any time during the day, but in their largest numbers between two and five, reaching their maximum, however, between three thirty and four thirty in the afternoon. These observations suggest that male beetles neither leave the berry nor fly.

In an experiment, which consisted in encircling the trunks of coffee bushes with sticky bands, no males were seen either below, in or above these bands. On the other hand, females were collected below, in and above such bands. This result indicates that males do not reach the bushes either by flying or walking or descend to the ground by way of the stem. The wings of the female are fringed and comparatively large, being about 2.2 mm. in length; those of the males are not fringed and are much reduced,* being about 0.34 mm. in length, and, although the male beetle is much smaller than the female, the wings in the male do not appear to be sufficiently large for sustained flight. Again, if the male beetle is roughly handled or laid on its back, it has rarely been observed to spread its elytra.

Since healthy males have never been seen to leave the berry, the female beetles are either rendered fertile within the berry, in which they have reached maturity, or, provided that no males are present within that berry, enter other berries for the purposes of finding a male. That the female migrates from a berry, either on the ground or on a bush, to other berries has been confirmed on many occasions.

The variation in the proportion of the sexes is significant. In a collection of 744 beetles from ripe berries, 731 were females and only 13 were males. This proportion of females is high and is explained by the fact that males do not migrate from one berry to another. A collection of 200 black berries from the ground yielded 635 beetles, of which 576 were females and 59 were males. This proportion of females to males is low, and suggests that some females may have left these berries before they were collected. In weekly collections of 513 ripe berries from bushes, from which the green bored and black berries were not removed, 577 beetles were obtained, of which only 3 were recently emerged beetles. From these same berries, 296 pupae were collected, of which 273 were females and 23 were males. This result shows that male to female pupae bear a relationship of one to thirteen and may be considered to represent closely the proportion of the sexes of the beetle.

Parthenogenesis, *i.e.* reproduction without the intervention of a male, does not occur. The female, if isolated immediately on its emergence from the pupa, has never been observed to lay eggs, this act only occurring after the introduction of a male. Female beetles, which are removed from berries con-

* Occasionally very small beetles resembling males in size have been seen flying but, on examination, the wings have been found to be large and fringed, resembling those of the females.

taining eggs, will continue to lay eggs without the presence of a male beetle, indicating that they only require to be once fertilised. Females may lay eggs from four to fourteen days after emergence from the pupa so that, in order to reduce to a minimum the possibility of recently emerged females leaving berries and entering others for egg laying, weekly collections of berries should be conducted. Throughout the period of the life of the female, egg laying is more or less continuous. She rarely lays more than sixteen eggs at a time and frequently several days pass without eggs being deposited. The maximum number of eggs laid by an individual female has been found to be sixty. The eggs hatch in about 5—7 days, generally 6 days, into curved and legless grubs. They feed upon the bean and become full-grown in about 12—20 days, the general average being 17 days. Many individual grubs have been successfully reared to pupae without the presence of the beetle. The grub remains quiescent for a period of about two days before transforming to pupa. The pupa is found within the coffee bean and the duration of this stage is from 4—7, with an average of 5 days. A coffee berry may provide sufficient nutriment for at least 104 representatives of this beetle, since, in one fallen berry, forty four grubs, thirty six pupae and twenty four beetles were counted. It is possible too, that female beetles may have left this berry and migrated to other berries, either on the ground or on the bush. The maximum number of 99 beetles, 90 females and 9 males, was found in a black berry on the ground: this berry contained no other stages of this beetle. In addition to other stages, the maximum number of grubs found in any one berry was 70.

The Life Cycle may be summarised thus:—

		Days.	Average number of days.
Egg to Grub	...	5 — 7	6
Grub to Pupa	...	12 — 20	17
Pupa to Beetle	...	4 — 7	5
		<hr/>	<hr/>
		21 — 34	28
		<hr/>	<hr/>

The minimum number of days for the complete life cycle is therefore 21 with a maximum of 34, and an average of 28 days.

The Preference for Coffee Berries and Varieties.

The susceptibility of a coffee berry to attack depends almost entirely on its age and its variety.

1. THE AGE OF THE BERRY.

In order to ascertain the age, *i.e.* the stage of the development of the berry when it is most susceptible to attack, several collections of berries in different stages of development of the Robusta variety were examined. The results on a 100 berry basis are tabulated below and are generally applicable to other coffee varieties.

		Eggs.	Grubs.	Pupae.	Beetles.	Total.
Bored green berries	...	19	3	0	53	75
Bored ripening berries	...	278	58	1	84	421
Bored ripe berries	...	495	329	49	95	968
Bored black berries on the bush	...	272	418	67	107	864
Bored black berries on the ground	...	14	42	20	318	394

The time from the flowering of the Robusta variety until the berry is ripe, when it measures about twelve mm. across its greater diameter, is from about eight to nine months. Very young green berries are rarely attacked and the damage to berries from about four to six months is limited to the feeding of the beetle. Berries older than six to seven months, *i.e.* when the greater diameter is from about seven to ten mm., may contain in addition eggs and grubs, their numbers increasing according to the degree of hardness, *i.e.* the age of the bean.

The ripening berries are more heavily attacked than green berries of six to seven months old but less than ripe berries of about eight to nine months old. The small undeveloped black berries on the bush have occasionally been found harbouring beetles, which have generally been dead, but the larger black, and, therefore, older berries on the bush, generally contain all stages of the insect. The figures above show that bored ripe berries are most heavily infested, and, whilst the fallen black berries contained the least number of eggs, they harboured most beetles, and before these berries were collected some beetles had probably left to continue their work of destruction. The number of bored green berries of all ages examined was 1526 and, whilst containing only 286 eggs and 50 grubs, 809 beetles were recorded, thus demonstrating that the beetles favour the green berry for feeding purposes.

The selective preference for berries by the beetle is interesting, but the most important consideration is that the black unremunerative berries on the bush and on the ground harbour and provide sufficient nutriment for the development of large numbers of the beetle. It is, therefore, most important that all black berries whether on the bush or on the ground be collected and disposed of. This aspect of the question will be discussed under control, but the importance of disposing of black berries may still further be emphasised by recording that one black Robusta berry collected from the ground was found to be harbouring 99 beetles—93 females and 6 males. (This figure is not included in the above numbers).

2. VARIETY.

A considerable variation in the number of bored berries from different coffee bushes of the same variety occurs. In illustration of this, collections of ripe berries were made on the same day from two bushes, growing next to each other, of the Robusta variety. From the one, 211 unbored and 59 bored and

from the other, 8 unbored and 184 bored ripe berries were collected. At the time of the collection, the berries from the bush with the higher infestation were observed to be softer and their skin more shining. It seems probable that the variation in the texture of the pulp is a factor governing the intensity of attack to the berry.

In an area supporting several varieties of coffee, growing in close proximity to each other, two to three hundred ripe berries of each variety were examined† regularly every week in order to ascertain the variety most subject to attack.

The detailed analysis of the unbored and bored berries from these collections need not be given; the result on a 1,000 berry basis was as follows :—

		Unbored.	Bored.
Abeocuta	...	993	7
Excelsa	...	986	14
Liberica	...	953	47
Robusta	...	841	159
Canephora	...	711	289
Uganda	...	635	365
Quillou	...	230	770

Bunting and Milsum* observe that Abeocuta, Excelsa and Liberica are varieties of the Liberian type of coffee and Robusta, Canephora, Uganda and Quillou of the Robusta type and give the proportion of fresh berry to dry bean as follows :—

Liberian Type.		Robusta Type.	
Liberica	10 to 1.	Robusta	4.5 to 1.
Excelsa	7.5 to 1.	Canephora	4.5 to 1.
‡Abeocuta	7 to 1.	Uganda	4 to 1.
		Quillou	4 to 1.

It is interesting to observe that the berries, viz :—the Liberian varieties, with a larger proportion of pulp are less subject to attack. The beetle generally enters the berry through the nipple, very occasionally holes have been observed in the sides of the berry, and, although there would appear to be good grounds for stating that this beetle prefers berries with the smallest proportion of pulp, the ease with which the beetle can penetrate the nipple may determine its preference, since the nipple of the Robusta varieties appears to be softer than that of the Liberian varieties. The susceptibility of the varieties of Robusta coffee may be due to odoriferous substances in the skin but, whilst this may be true, the proportion of the pulp or the degree of hardness of the nipple cannot be wholly ignored. Liberian coffee is considered to be most suited to the peaty soil of the coastal district, Robusta to inland virgin land and Arabian§ coffee for cultivation

† Mr. J. L. Greig, Assistant Agriculturist, kindly forwarded the writer each week a consignment of berries of each variety for examination.

* "The Cultivation of Coffee in Malaya", *Malayan Agricultural Journal*, Vol. XVIII, No. 10, October, 1930.

‡ The writer is responsible for this figure.

§ The writer has had no experience with this beetle in its relationship to Arabian coffee.

in the hills. The suitability of the soil to the variety of coffee must of necessity be considered, but, so far as *Stephanoderes* is concerned, preference should undoubtedly be given to those which are less subject to attack, viz:—the Liberian varieties, Excelsa, Liberica and Abocuta.

Enemies.

No parasitic or predaceous insects have been recorded in Malaya. An entomophagous fungus (*Botrytis stephanoderis* Bally), parasitic on the beetle, is generally distributed but is not effective in reducing its numbers. Beetles which have been killed by this fungus are revealed by a whitish looking deposit at the entrance hole at the nipple of the berry and are frequently associated with the green berry.

In Java, the predaceous bug, *Dindymus rubiginosus* F., has been recorded as an enemy of the beetle but apparently is of little importance. Swallows have also been observed catching the beetles.

Two hymenopterous parasites, viz. the Bethyloid, *Prorops nasuta* Waterston and the Braconid, *Heterospilus coffeicola* Schmeidl, indigenous to Uganda, have been imported into Java and the former into Brazil. *P. nasuta* became established in Java, but Dr. Leefmans in correspondence in 1929 informed the writer that it had proved of little importance with regard to the suppression of the pest.

The Control.

This beetle is not present in all coffee areas in Malaya and precautions should, therefore, be taken to prevent its introduction into those areas which are free and into those areas which are intended for coffee, and, since it has not been found breeding in any other seed, attention need only be directed to the coffee bean, and more especially, if it is intended for planting purposes. In opening up new areas, it is advisable to ascertain if isolated coffee bushes occur in the neighbourhood and, if infected, to endeavour to have them destroyed or to keep them free from berries for some six months, since after that period no beetles should exist, and to have all fallen berries collected.

In order that the destruction of infested bushes or the collection of berries on the bush and on the ground may be effectively carried out, intending cultivators may consider it to be desirable to pay the owners compensation for loss of crop.

1—THE TREATMENT OF THE BEAN FOR PLANTING AND COMMERCIAL PURPOSES.

All seed intended for planting whether for "new" or established areas should be fumigated.

Hydrocyanic acid gas and carbon bisulphide have proved successful fumigants in rendering the seed free from beetles, but are not recommended, owing to the care required in using these substances, the difficulty in procuring them, their liability to reduce the germination of the seed and the simplicity and effectiveness of fumigation with turpentine.

Dr. H. Begemann of the Malang Experiment Station was the first to advocate

the fumigation of coffee seed with turpentine and Dr. S. Leeftmans very kindly sent a translation of the description of this method to the writer in March, 1929. In a recent paper, Dr. Begemann has described * the fumigation of seed intended for planting purposes with turpentine. This method has been practised by this Department and has proved to be eminently successful in killing all stages of this beetle.

A sample of infected seed, which had been fumigated with turpentine for three days, was examined with the following satisfactory result.

Number of beans bored by <i>Stephanoderes</i>	...	108.
Number of collapsed eggs	...	70.
Number of dead grubs	...	112.
Number of dead pupae	...	45.
Number of dead beetles	...	58.

No live forms were observed in any of these beans.

Germinating tests† have been made with 250 seeds mixed with charcoal before and after fumigation with turpentine.

Of the seeds mixed with charcoal before fumigation 135 (54 per cent.) and after fumigation 177 (71 per cent.) germinated. This result demonstrates the importance of mixing the seed with charcoal after fumigation.

The method is briefly as follows:—

A kerosene tin is fitted with 8 trays made of a 8 mm. mesh, their upturned edges being about 4 cm. A cloth which has been soaked with turpentine is then placed in each tray and on top of the cloth a layer of coffee seed about 4 cm. in depth is placed. The kerosene tin is closed with a tightly fitting lid which may be made more air-tight by surrounding the rim of the lid by a rubber band of about 4 cm. in width.

The seed is fumigated for a period of three days, after which time, all stages of the beetle will have been killed. The seed is afterwards aerated in another kerosene tin, fitted with similarly sized trays, but with its sides replaced by fine gauze to prevent the entrance of the beetle and to allow free circulation of air. For larger quantities of seeds, drums, barrels, boxes or similar utensils may be used. The seeds after being fumigated are mixed with fine charcoal.

The introduction of this beetle through infested coffee beans prepared for consumption is possible, but the process of fermentation and of drying the coffee bean is generally fatal to all stages of this beetle. It has, however, been reported in Europe in prepared coffee beans intended for consumption, and found in Malaya in beans after the operation of pulping, and in beans, admittedly in small numbers, ready for the market. In order to eliminate the possible danger of its spread in market coffee, and also to assist in its control, all coffee berries, prior to pulping, should be immersed in boiling (not merely hot) water, small

* Archief voor de Koffiecultuur in Nederlandsch—Indie, IV, No. 2, October, 1930.

† These tests were made by Mr. J. L. Greig, Assistant Agriculturist.

quantities for $1\frac{1}{2}$ mins. and large quantities (sack full) for a period of 3 mins.,* and then afterwards completely submerged for a period of four days. Submersion of the berries is not sufficient, not only do the beetles leave the berries during this treatment but all stages of the beetle have been found in berries which have only received this treatment, the beetles escaping immediately the beans are dried. It has been stated that, after immersing the berries in boiling water, the quality of the bean is impaired. The writer considers this to be an erroneous impression. He is well aware that bored beans which have been treated become discoloured, but, in any case, such beans have generally been so heavily attacked by the beetle that they are almost worthless.

II—THE TREATMENT IN THE FIELD.

The writer is of the opinion that no reduction in the number of this beetle, and, therefore, no increase in the yield of beans, will result, unless black berries, on the bush and ground, and bored green and ripe berries, are regularly and frequently collected and treated.

It has been suggested in conversation that this beetle, although causing a considerable reduction at first in the yield of coffee beans, eventually diminishes in numbers and, as a result, is responsible for less injury. The writer considers, if less berries are bored, that this reduction has been brought about by instituting a more regular and frequent collection of the berries. A coffee area, where berries are occasionally collected, that is to say an area more or less in an abandoned state, has been under observation for more than a year, and during that period berry infestation of about ninety per cent has been maintained.

In this infested area, experiments in weekly, fortnightly, three weekly and monthly collections have been in progress. The opportunity to confirm the results of these experiments in different areas has not been offered, but they show, even in this heavily infested area, a considerable reduction in bored ripe berries of individual bushes. With the exception of the control, all bored green and black berries of the experimental bushes were collected at the same time as the ripe berries. No black or fallen berries were gathered from the ground. The figures for ripe berries are placed on a percentage basis and are as follows:—

Period of collection		Per cent. Bored ripe berries	Per cent. Unbored ripe berries
Weekly	...	10	90
Two weekly	...	21	79
Three weekly	...	24	76
Four weekly	...	34	66
Control; weekly, ripe berries only	...	89	11

If, however, the number of bored black and green berries which were re-

* Mr. J. L. Greig, Assistant Agriculturist, immersed a sack full of coffee berries in boiling water for three minutes and forwarded a quantity to the writer for examination. Only dead forms were seen.

moved from these same bushes, is included, the ripe unbored berries collected on a percentage basis are as follows:—

Weekly	...	58
Two weekly	...	41
Three weekly	...	* 43
Four weekly	...	* 43
Control—weekly, ripe berries only	...	11

Although this result is not so significant, it demonstrates the advantage of removing the bored green and black berries, since, even in the weekly collections, where the fall of berries would be small during a week, an increase of forty seven per cent. in the harvest of ripe berries is obtained.

In order to illustrate still further the importance of weekly collections of ripe, bored green berries (and black if any,) from the bush, only the ripe berries from two bushes in this heavily infested area were collected over a period of eleven weeks, and, after obtaining the percentage infestation of ripe berries, the bored green and black berries, if any, in addition to the ripe berries over a period of forty eight weeks were removed.

The result is tabulated below:—

		Ripe unbored berries collected	Ripe bored berries collected
Bush 13	Ripe berries only removed	19	607
	All ripe, black and green berries removed	1893	86
Bush 17	Ripe berries only removed	15	348
	All ripe, black and green berries removed	426	74

By carrying out the collection of all bored green berries (and black, if any) the proportion of unbored ripe to bored berries, in Bush 13, rose from 1 to 32 to 22 unbored to 1 bored and, in Bush 17, from 1 to 23 to 6 unbored to 1 bored.

The above result is of definite economic value as illustrating the necessity of the frequent collection, not only of the ripe bored and ripe unbored berries, but of the bored green and black berries.

The harvest of ripe unbored berries from these two bushes, prior to the weekly collection of bored green berries, was about 3 per cent., but after the collection of these berries, the harvest of ripe unbored berries rose to 93 per cent. In the case of Bush 13, 695 and Bush 17, 671 bored green berries were removed and if these figures are considered, the harvest of ripe unbored berries is reduced to 60 per cent., but this is a significant increase of 57 per cent. in ripe unbored berries over the 3 per cent. when the green bored and black berries were not removed.

* It is possible that, during the intervals of three and four weeks, a considerable number of bored berries dropped to the ground. This would account for the increase in the number of unbored ripe berries collected.

Some of the collections of berries from the above experiments were examined, from which the following figures relating to the maximum number of living stages in an individual berry were obtained.

Nature of Berry	Collected at intervals of	Beetles		Eggs	Grubs	Pupae
		Male	Females			
Ripe	one week	—	2	36	—	—
"	two weeks	—	1	4	15	—
"	three weeks	—	1	14	22	—
"	four weeks	—	26	1	22	14
Black from ground		—	24	0	44	36
Black on twigs		—	15	0	70	4

The above figures must not be taken to mean that grubs are never found in berries which are collected weekly, that no pupae are present in berries collected every three weeks and that male beetles are not seen in ripe berries collected every four weeks or in black berries on the bush or the ground. The maximum number, 104, was obtained from a single fallen black berry: it has already been recorded that ninety nine beetles were collected from one fallen berry,—no other stage being observed.

The number of forms * which inflict immediate damage to the bean are two in the weekly, sixteen in the two weekly, twenty three in the three weekly, forty eight in the four weekly, sixty eight in the fallen black and eighty five in the black berries on the twigs.

The following relates to the maximum number of any living stage found in green, ripe and black berries on the bush and on the ground.

Number of berry	Collected at intervals of	Beetle		Eggs	Grubs	Pupae	Total
		Male	Females				
Green	One week	—	3	2	—	—	5
"	Two weeks	—	1	8	—	—	9
"	Three weeks	—	2	8	—	—	10
"	Four weeks	—	2	19	15	—	36
Ripe	One week	—	2	36	17	—	55
"	Two weeks	—	2	21	18	—	41
"	Three weeks	—	8	25	25	14	72
"	Four weeks	4	26	24	38	21	113
Black on the bush		4	45	28	70	30	217
Black from ground		9	90	13	44	36	195

* Forms = Grubs and Beetles,

The greatest number of eggs found in any one berry was 36, of grubs 70, of pupae 36, of female beetles 90 and of male beetles 9.

The above figures also show that all stages of this beetle, which include the male beetle, are found in maximum numbers in ripe berries collected at an interval of four weeks, and in black berries on the bush and on the ground, and demonstrate (1) the importance of frequent collection of ripe and black berries and (2) of weekly collections, especially if consideration is given to the increase in numbers, *i.e.* the greater destruction of beans, when the interval between collections is extended to more than one week.

The importance of the weekly collection of bored green berries is also demonstrated by the following figures:—

Collected at an interval of	Number of berries examined	Number of beetles	Number of eggs	Number of grubs	Per cent of berries containing beetles
One week	385	177	1	—	46
Two weeks	137	80	12	—	58
Three weeks	267	157	12	—	58
Four weeks	353	218	260	50	62

A considerable increase in beetles, eggs and grubs occurs if the collection of green bored berries is not more frequent than every four weeks.

The consideration of the above results clearly emphasises the importance of the weekly collection of all bored green, ripe and black berries on the bush and on the ground, and every endeavour to control this insect should be made by inaugurating a weekly collection of the above enumerated berries.

The beetle lives for about four months and its minimum life cycle is 21 days, so that, on theoretical grounds, if, throughout an area, all bored green, black from the ground and the bush, and all ripe berries could be collected on the same day and the collection of all such berries continued at an interval of less than three weeks during a period of four months, no individuals would remain. On a small area, this procedure may be possible, but, on a large area, the aim should be to clear it of all such berries in the shortest interval of time and to institute a regular weekly collection. If such a policy were adopted, the reduction in bored ripe berries would undoubtedly soon occur. In this connection, the harvesting of the just under ripe berries, in which the stages of the beetle are less numerous than the fully ripe berries, should be considered. It should be remembered that the longer the berries remain on the bushes, the greater the number of all stages of this beetle within them and the greater the destruction of the beans.

The collection of fallen berries is of paramount importance, and, in order to facilitate this and to make it as complete as possible, the growth of weeds

and cover crops should not be encouraged, since they will militate against the successful control of this insect.

The importance of weekly collections of all ripe, bored green and black berries on the bush and on the ground has been stressed. The aim is to reduce this beetle to such small numbers that it ceases to be a pest, and any measure which will assist in this direction should be practised.

The coffee berry is either collected in baskets or bags. Baskets should not be used, since the beetles are able to escape from the berries through the interstices. Bags made of closely woven material should be substituted for baskets. They should not be completely filled as the over-lap will form a flap, thus closing the bag and preventing the escape of the beetle. Separate bags may be employed for collecting the green bored and black berries from the ground and bush. The bags containing the berries should be immersed in boiling water, (v. page 9), if possible in the field, thereby killing the beetle and automatically reducing its numbers in the vicinity of the factory. This procedure, however, may be considered to be impracticable in the field, but it is, nevertheless, essential for the control of this insect that all berries, whether treated in the field or near the factory, should be immersed in boiling water before pulping is begun. If this operation is delayed, the berries should be placed in receptacles to prevent the escape of the beetle. This precaution should be carried out with due regard to the fact that the beetle, in maximum numbers, leaves the berry between three thirty and four thirty in the afternoon, and, during these hours, the less the berries are disturbed the better.

In conjunction with the above, the factory and its vicinity should be kept clean and all refuse burnt. No residue in which the beetle may breed should remain in the store, within the factory or in its vicinity.

In Malaya, the climate is generally similar to that of Sumatra and, in both countries, coffee berries are produced continuously throughout the year. There is no definitely marked coffee season. In Java, a dry season, when few berries are produced, occurs and advantage is taken during this time to institute a "dead" season. During this season, no berries are allowed to form and all possible breeding places, such as fallen berries, receive attention. By this procedure, this beetle in Java is not, by any means, so important a pest as in Sumatra and Malaya. The institution of a "dead" season in Malaya implies a considerable reduction of crop, with the ultimate risk of the area becoming re-infected, and should only be recommended for isolated coffee areas, where there is no risk of re-infection, or where owners of cultivated areas in the vicinity of each other agree to co-operate and supervise efficiently the collection and treatment of all berries and the prevention of the formation of berries. A "dead" season should be for a period of six months and, during that time, no berries should be allowed to form and all berries on the bush and ground must be collected and treated. One undiscovered berry may become the focus for a general increase of this insect and the aim of eliminating this beetle by starvation will have been frustrated. Mr. W. H. Barnes, Agricultural Field Officer, Negri Sembilan, who instituted

a "dead" season of six months in an isolated area of infested coffee, informed the writer that he examined the area after eighteen months and, although the trees were fruiting heavily and ripe coffee was plentiful, he was unable to find a single case of a bored coffee berry.

Acknowledgments.

I should like to express my very grateful thanks to Dr. S. Leefmans, Head of the Institute for Plant Diseases, Java, for his ready assistance, and for the information concerning this beetle, which he willingly placed at my disposal, in February, 1929.

I also wish to record my appreciation of the work of Che Mohamed Yusope, Malay Agricultural Assistant, Grade I, and Che Abu Hassan, Malay Agricultural Assistant, Grade II, who have been most helpful in recording the data on which this paper is largely based.

Summary.

1. *Stephanoderes hampei* is an introduction into Malaya and was first discovered in Selangor in January, 1929.
 2. A general description of the stages of the beetle is given.
 3. With a berry infestation of 50 per cent., a direct reduction in beans of 26 per cent. results.
 4. The beetle may live for four months. The proportion of females to males is about 13 to 1. Only the female beetle flies. It is rendered fertile within the berry in which it completes its cycle or migrates to other berries for this purpose.
 5. Green berries are favoured for feeding. The ripe and black unremunerative berries on the bush and on the ground are heavily infested by this beetle and are favoured for breeding purposes.
 6. The Liberian varieties of coffee being less subject to attack than the Robusta varieties should, if conditions are favourable, be planted.
 7. All beans for planting should be fumigated with turpentine. The method is described. Coffee berries for commercial purposes should be immersed in boiling water prior to pulping.
 8. The decrease in the number of bored ripe berries resulting from the weekly collection of all bored ripe and green berries and black berries on the bush and ground is demonstrated.
 9. A 'dead' season of six months, when no berries are allowed to form and when all black berries on the ground and bush are collected, is only recommended for isolated coffee areas and where owners are willing to co-operate and supervise efficiently the treatment and collection of all berries.
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BLEACHING OF PALM OIL,

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Introductory.

In view of the increasing Malayan production of palm oil and the recently imposed duties on imported oils and fats for edible purposes, several enquiries have been received as to the possibility of the introduction of palm oil to the local market having regard both to the high quality of the estate product and its present relatively low price.

Although, at present, palm oil finds its principal applications in soap-making and tin-plating, the oil is also employed to a certain extent in the manufacture of edible products and it seems reasonably certain that, as larger and more regular supplies of this high grade oil become available, an increasing use for edible purposes will result.

While estate palm oil is of high quality and is therefore suitable for edible purposes, the marked red colour of the oil is a disadvantage and recourse must therefore be had to bleaching.

Although, as will be seen later, bleaching constitutes only one stage in the complete refining process of an oil for edible purposes, it is the most important stage as far as local consumption is concerned, since it is well-known that with certain classes of the community the intense colour of the crude oil is one of the objections to its adoption, for example as a cooking oil. Further, it must be remembered that the other local oils, notably coconut oil and groundnut oil, with which palm oil would compete and which are not subjected to any refining process, are only slightly coloured.

It was felt, therefore, that if some simple means of bleaching palm oil could be found, the local utilisation of the oil on a wider scale might be envisaged; the oil at present being used locally only to a very small extent in the manufacture of soap, for which purpose also it is preferable to use a bleached oil.

While the present paper deals primarily with experiments carried out regarding a simple method of bleaching the oil to a sufficient extent to enable it to meet local requirements, it is also proposed to refer briefly to the properties of palm oil and to the question of the complete refining of an oil for edible purposes.

Properties of Palm Oil.

It is well-known that the hardness of palm oil varies with the acidity; an oil of low acidity, such as that produced by estates forming, when freshly prepared, a thin, pasty, deep orange-yellow mass. On standing at the ordinary temperature, the mass will separate gradually into two layers, a deep red liquid fraction superimposed on a solid, yellow coloured fraction.

It is possible to effect separation by filtration through paper or canvas, as a result of which it will be found that the two fractions are present in approximately equal proportions by volume.

From a chemical point of view, palm oil is classified as a vegetable fat, some of the physical and chemical constants of estate oil being as follows:—

Oil

Specific gravity at 99.5°C (water at 15°C = 1) ...	0.860	—	0.861
Saponification value ...	201.0	—	202.5
Iodine value (Wijs) ...	50.3	—	52.7
Acidity (palmitic acid per cent.) ...	4.2	—	5.8

Fatty Acids

Solidifying point (Titer value) ...	44.9	—	46.3°C.
Mean molecular weight ...	270	—	271
Iodine value (Wijs) ...	52.5	—	54.2

With regard to the range of acidity quoted, it may be pointed out that the figures are now considered slightly high for an estate product. The particular samples of oil were, however, obtained from estates on which the fruit was separated in the field, the loose fruit being brought into the factory for treatment. On account of the inevitable bruising associated with the handling of the loose fruit, the acidity of the resultant oil is always slightly greater than if the bunches are first sterilised before separation of the fruit. Since the process of bunch sterilisation is gradually being adopted, it should soon be possible for any estate under normal working conditions to maintain the acidity of its oil between 3 and 4 per cent., calculated as palmitic acid.

According to Drummond and Coward (1) the colour of palm oil is due to a mixture of carotene and xanthophyll in the proportion of 3 parts of the former to 1 of the latter. It may be mentioned that carotene is a hydrocarbon (a chemical compound containing only carbon and hydrogen) having the formula $C_{40}H_{56}$, while xanthophyll has the formula $C_{40}H_{56}O_2$, that is, it contains the same number of atoms of carbon and hydrogen, and in addition two atoms of oxygen.

The presence of these fat-soluble pigments is interesting from the point of view of the nutritive value of the oil, experiments (2) having shown that, while the majority of oil seeds employed for the preparation of edible oils and fats contain relatively very small amounts of vitamin A, a fat-soluble vitamin, the activity of palm oil in this respect is remarkably high.

As is well-known vitamin A is considered to be associated with bodily growth

and vigour and there is reason to suppose that the absence of this vitamin in a diet lowers resistance to infection, more particularly in the case of diseases of the pulmonary tract.

It would appear, therefore, as if there is some relation between vitamin A and the fat-soluble pigments present in palm oil, so that from a purely nutritive point of view bleaching is not advisable owing to the destruction of the pigments during the process.

The questions of the nutritive value of palm oil and of an adequate supply of vitamin A in a diet are, however, outside the scope of this paper, reference being made to these questions purely from the point of view of information regarding the properties of the constituent chemical compounds to which palm oil owes its colour.

General Description of Methods for Bleaching Palm Oil.

The principal methods employed for bleaching palm oil on a large scale can be classified as follows (*a*) adsorption of colour by bleaching earth (*b*) chemical bleaching, involving oxidation or reduction (*c*) air-bleaching with or without the addition of a catalyst.

The above classification is by no means exhaustive; there are other means available, for example, palm oil can be bleached satisfactorily by exposing the oil in a thin layer to the action of sunlight. Such a method is scarcely practicable on a large scale, even in Malaya, on account of the absence of a prolonged dry season.

Further, as will be seen later, bleaching can be effected by heating the oil to a temperature of approximately 240°C and it is understood that such a method has been proposed for adoption on a commercial scale, the treatment being carried out *in vacuo*.

With regard to the three methods mentioned above, bleaching of the oil with fuller's earth is the method chiefly used in Europe, especially when a high-grade product is required, since in the preparation of an edible oil it is essential to effect the necessary purification under conditions in which the quality of the oil will be affected as little as possible. A physical method of bleaching, using a substance such as fuller's earth, is therefore, to be preferred to one of the more drastic chemical methods to which reference will be made later.

Satisfactory bleaching with fuller's earth is a rather intricate process. It appears as if the best results can only be obtained if the oil is first activated by means of treatment with dilute acid prior to the addition of the bleaching agent. The oil and fuller's earth are heated *in vacuo* with constant agitation in order to ensure the maximum effect, the temperature being gradually raised to 100°C in order to expel excess of moisture. The oil is then cooled and filtered to remove the bleaching agent. The object of treatment in absence of air is to ensure the quality of the oil being affected as little as possible in view of the necessity of raising the temperature so as to effect the necessary bleaching.

A relatively large amount of palm oil, more especially oil used for soap manufacture, is still bleached by chemical means; for example, sodium dichromate and a mineral acid, hydrochloric acid or sulphuric acid, the bleaching action being accelerated by blowing air through the mixture, which is warmed to a temperature of approximately 40°—50°C. Subsequently, the oil must be washed with water two or three times in order to remove soluble salts and excess acid.

Palm oil can also be bleached by heating in a current of air with or without the addition of a catalyst* (3). Further, the amount of catalyst needed to produce the necessary effect is very small; as will be seen later, an amount of one-hundredth part per cent. by weight of the catalyst, calculated on the weight of oil, is sufficient to reduce the period of bleaching by approximately 75 per cent.

Although the usual method of air-bleaching is to blow or aspirate the air through the heated oil in the absence of a catalyst, a more rapid effect is likely to be produced by exposing the oil in as fine a state of division as possible to the action of the air. This can be accomplished by introducing the oil into the bleaching chamber in the form of a fine spray, the temperature being maintained by means of high-pressure steam.

Omitting, therefore, the methods of bleaching by means of fuller's earth and by the addition of chemical reagents as being too intricate for present adoption on a large scale, it was decided to restrict the experiments to the method of air-bleaching.

Air-Bleaching of Palm Oil.

In view of the necessity of making the process as simple as possible, some experiments were first carried out by merely heating the oil in an open vessel, with only occasional stirring.

It was found that a fairly satisfactory bleaching action could be effected by heating the oil to a temperature of approximately 240°C and maintaining that temperature for a period of approximately 5 minutes. When discussing the various methods of bleaching palm oil, reference was made to such a process, except that it was carried out *in vacuo*, under which conditions the quality of the oil would not be affected to the same extent as by allowing access of air.

When heated in air the oil developed a greyish tint, the coloration becoming slightly more marked on storage, while in addition, the odour became more pronounced. Such a process is, therefore, not to be recommended, since in addition to these defects, there is a difficulty of heating a large quantity of oil to such a relatively high temperature, which is approximately only 50° less than the flash-point of the oil, 290°C. The proximity of the temperature to which the oil is heated to the flash-point suggests the possibility of a slight decomposition effect as evidenced by the development of the greyish colouration.

By reducing the temperature to 150°C., at which temperature the quality of the oil would not be affected to the same extent, and aspirating or blowing

* A catalyst is a substance which allows a chemical reaction to proceed more rapidly, itself remaining unchanged on the completion of the reaction.

air through the oil at a rate of approximately one-hundredth part of its volume per second, it was found that a satisfactory bleach could be effected in approximately 3 hours.

Further experiments showed that, maintaining the same rate of air supply to the oil, the rate of bleaching was dependent on the temperature, the lower the temperature the longer the period necessary to effect a bleach; for example, at a temperature of 110°C. a period of even 7 hours was insufficient to bleach the oil completely.

A series of experiments carried out to determine whether the rate of bleaching was affected by the acidity of the oil resulted in the conclusion that, although the acidity of the oil was only 4 per cent. calculated as palmitic acid, the rate of bleaching was considerably retarded when neutral oil was used. This is an advantage since, if the object of the treatment is the production of a bleached neutral oil, it is possible to combine in one operation both the neutralisation of the free fatty acids and the washing of the oil to remove small quantities of certain soluble odoriferous compounds, possibly produced during bleaching. A previous series of experiments had shown the appearance and the odour of the bleached acid to be improved by washing with hot water, the improvement becoming still more marked if the washing was combined with a preliminary treatment with alkali to remove free fatty acids in addition.

The experiments on the catalytic bleaching of the oil were based on the investigation of Sastry (3) referred to previously, compounds of cobalt, nickel and manganese being used as catalysts. Probably on account of the differences in acidity, the results of the two investigations are not comparable, the oil with which Sastry carried out his experiments having an acidity of approximately 22.5 per cent., calculated as palmitic acid, while that used in the present series had an acidity of only 4 per cent., calculated on a similar basis.

The catalysts used were confined to the borates and resinates of the three metals mentioned above, the respective compounds themselves being prepared by double decomposition of a soluble salt of the particular metal; for example, cobalt sulphate, with the requisite amount of a solution of sodium borate (borax) or sodium resinate. In each case the precipitate was washed with water till free from soluble salts and dried.

As explained previously, only a very small proportion of catalyst was required, the amount necessary for effective bleaching being of the order of 0.01 per cent. by weight of that of the oil being bleached.

Further, as found by Sastry, the addition of a catalyst enables the bleaching action to proceed at a lower temperature; as will be seen later, effective bleaching with such a catalyst can be carried out at a temperature of approximately 90°C. This has an important bearing both on the quality of the oil and the machinery required. As regards the former, the lower the temperature at which the bleaching action can be effected the less the quality of the oil will be affected; while as regards the type of plant necessary, the fact that bleaching can be carried out below a temperature of 100°C would facilitate control of tempera-

ture, since steam can be used as the heating agent.

The results of a series of experiments in which the different catalysts were used are shown in the following table. In all cases the same quantity of oil was used and the amount of catalyst maintained at 0.01 per cent. of the weight of oil. Bleaching was also carried out at approximately 90°C., while as far as possible a uniform rate of aspiration of air through the heated oil was maintained in every case.

The periods of bleaching are only approximate, the colours of the various samples of the bleached product being compared merely from tubes of the oils cooled under similar conditions, using a sample tube of oil, fully bleached but without a catalyst, as a standard.

Catalyst.		Period of Bleaching hours.
Cobalt borate	...	2.5
Manganese borate	...	9
Nickel borate	...	12
Cobalt resinate	...	1.5
Manganese resinate	...	7
Nickel resinate	...	13

The results of the experiments show the superiority of the two cobalt compounds as catalysts, compared with those of manganese and nickel.

Although cobalt resinate is superior to cobalt borate as regards bleaching action the latter is to be preferred, since cobalt resinate is soluble in the oil, whereas the cobalt borate, being insoluble, can be removed from the bleached oil by filtration. No traces of cobalt could be found in the filtered oil bleached by cobalt borate.

Before discussing the application of the method of bleaching to local conditions attention might be drawn to another investigation that was carried out as regards bleaching both the liquid fraction and the solid fraction into which palm oil can be separated by filtration.

The object of this investigation was to demonstrate the possibility of bleaching the separate fractions, thereby being able to produce, if necessary, a liquid oil that would compare as regards colour with other oils used locally, for example, groundnut oil and a solid white fat of the consistency of other available fats.

It was found that the two fractions could be bleached as satisfactorily as the whole oil, a period of approximately 3 hours at 150°C. being required to effect a satisfactory bleach when air alone was aspirated through the heated oil, while using the same amount of cobalt borate as in experiments with the whole oil it was possible to carry out the bleaching in approximately 2 hours at 100°C.

Although the liquid fraction when first bleached is a clear pale-yellow oil it is found that after storage for two months a small amount of greyish-white solid is deposited. The deposit probably consists of solid glycerides, since they dissolve in the oil when the latter is warmed,

Local Application of Method of Air-Bleaching.

The results of the experiments with air-bleaching indicate the possibility of the production of a bleached palm oil of good quality without the installation of an expensive plant.

Although the quality of such a bleached oil could not be guaranteed to remain unchanged on prolonged storage on account of the insufficiency of the purification treatment, it is considered that such an oil might find an application, provided it could be used without delay.

The main plant required, which would not be expensive, would comprise a series of iron tanks, similar in design to those used for palm oil purification. Each tank should be fitted with an open steam pipe, an air injection pipe and a stirring gear for maintaining the oil in a state of agitation. If it is intended to use a catalyst, such as cobalt borate, it would be preferable to have a closed steam coil also fitted into the tank. With air alone this would be unnecessary, the tank being erected so that a fire could be lighted below. A mechanical blower would be necessary for the air supply.

The addition of a filter-press would be an advantage, especially in the event of catalytic bleaching, to ensure the removal of the whole of the catalyst and any matter in suspension.

In the event of the bleached oil being also neutralised, the question of the disposal of the alkaline sludge would arise. Unless this could be treated with excess mineral acid and the resultant acid oil, as it is termed, utilised for soap-making there would be a loss of oil. In general the loss in neutralising is approximately double the acidity; for example, if the acidity is 4 per cent., calculated as palmitic acid, then 100 parts of the crude oil will yield only 92 parts of the neutral oil.

Although the method of air-bleaching has been described as simple, the question of the necessity of careful control throughout the process cannot be too strongly emphasised, particularly when it is essential to maintain a standard product. Special attention would have to be paid to such points as period of bleaching, control of temperature, rate of air supply. For example, as regards the period of bleaching, laboratory experiments have shown that even though the temperature and the rate of air-supply may be maintained constant, there is an optimum period for heating the oil, after which the latter becomes slightly dull in appearance.

Since the bleaching of vegetable oils, which is only one branch of a highly specialised industry, vegetable oil refining, has been developed to such an extent that standardised bleached oils are now available in enormous quantities, it is essential to aim at a product of standard quality. The technique of oil bleaching is more complicated than that of oil production and it is doubtful whether, in the event of a demand arising for a bleached palm oil, the process could be recommended for general adoption on estates, unless the estates were sufficiently large to have separate oil refining sections under technical supervision.

Outline of Process for the Refining of Vegetable Oils.

Although the present paper deals primarily with the bleaching of palm oil, as indicated previously a brief reference will be made to the complete process for the refining of a vegetable oil to ensure an edible product of the highest grade.

Assuming that a good quality vegetable oil, such as estate palm oil, is available, and no preliminary treatment to remove sludge or mucilaginous matter is necessary, the process can be divided into three sections

- (i) Bleaching the oil (Decolorisation)
- (ii) Removal of acidity (Neutralisation)
- (iii) Removal of odour and taste (Deodorisation).

Although, according to the above scheme, bleaching precedes neutralisation, the order of these operations is sometimes reversed, being dependent on the character of the oil. For example, in the case of a very dark coloured oil, such as cottonseed oil, in which a certain amount of decolorisation would be effected as a result of treatment with alkali, it would be preferable to neutralise first, carrying out the bleaching with the neutral oil.

There is no necessity to refer again to the question of bleaching except to repeat that in the case of the preparation of a high grade edible product, a physical method of bleaching *in vacuo* is preferable to a chemical method.

The question of the neutralisation of the free fatty acids necessitates a determination of the acidity of the oil, from which can be calculated the amount of caustic soda refined both for neutralisation and a satisfactory separation of the oil and the alkali layer. An excess of caustic soda must be added; the amount will vary with the particular oil, while the temperature at which the neutralisation process is carried out also affects the separation of the oil and aqueous alkali layer. For example, in the case of palm oil, good results have been obtained using a solution of 10 per cent. caustic soda, adding 10 per cent. in excess of the amount required to neutralise the free fatty acids and carrying out the neutralisation at a temperature of approximately 90°C.

After treatment the neutral oil must be washed with water to remove traces of alkali and dried, preferably *in vacuo*, to remove moisture.

Although the oil has been bleached and neutralised it will still be found to have both odour and taste, either or both of which may be unpleasant, so that if such an oil were used for cooking purposes, the flavour of the food might be masked by that of the oil.

The deodorising system now practically in universal use is one relying on the distillation under reduced pressure of the substances causing the odour and the taste, either in the presence of superheated steam or an inert gas such as nitrogen, preferably the former.

Although a description of the odoriferous constituents present in vegetable oils does not come within the scope of this paper, it may be of interest to mention that such bodies consist of complicated organic compounds, for example,

aldehydes, which tend to change when the oil is heated in air, especially for prolonged periods, but which can be distilled unchanged *in vacuo*. Success in deodorisation depends, therefore, on the absolute exclusion of air both during the process and until the refined oil is cold again. A small leak in the deodoriser may cause a stream of air to pass through the oil and with the high temperature of the superheated steam the flavour of the oil will be entirely spoilt.

It is understood that a common practice is to blow steam superheated to 200°C. through the oil under a vacuum of approximately 29 inches of mercury. In order to give an idea of the amount of vacuum required it may be mentioned that the normal pressure of the atmosphere corresponds to approximately 30 inches of mercury.

The oil should require no further treatment after deodorisation, although it is understood that some refiners take the precaution of filtering the oil to remove traces of moisture, since it is well known that moisture influences the storage qualities of a vegetable oil.

The final product, when liquid, should be clear, bright, tasteless, odourless and neutral. Such an oil, which would be suitable for the highest quality edible purposes, should not revert during any reasonable period of storage prior to consumption.

As mentioned previously, the complete refining of a vegetable oil constitutes a highly complicated technical process and the brief description given above will furnish an idea of the high standard reached in this respect in the industry in Europe.

Hydrogenation of Oil.

When discussing the question of the refining of vegetable oils, a brief reference might be made to the process of hydrogenation, or hardening as it is also called.

The principle of hydrogenation is based on the fact that when an oil is heated with hydrogen in the presence of a catalyst, the unsaturated fatty acids present as glycerides in the oil unite with the hydrogen to form saturated fatty acids. Glycerides, in which the latter type of acids predominate, have a higher solidification point and therefore the fat tends to harden. For example, in the case of hydrogenated palm oil the liquid fraction disappears almost entirely, the product being a soft white fat.

As regards the catalyst the metal nickel in a suitable form is employed.

Further, since the degree of hydrogenation can be varied to suit the particular purpose for which the oil is required, and it is understood that most fats for edible purposes can be further improved and stabilised as a result of slight hydrogenation, the importance of the process will be realised. In this connection it may be mentioned that the marked degree of competition between various oils for a particular industrial purpose can be attributed to a large extent to the development of the hydrogenation process by which, for example, a fish oil

can be transformed into a fat of the consistency of tallow or one of even greater hardness.

It would appear, therefore, as if there were possibilities for such a process locally in the preparation of a vegetable butter as a substitute for ghee, and enquiries have already been made as regards a suitable type of plant for the carrying out of laboratory experiments not only with palm oil, but with other locally-produced vegetable oils.

Remarks and Conclusions.

The results of the investigation indicate that under local conditions the method of air-bleaching offers the best possibilities as regards a simple means of decolourising the oil. The quality of the bleached product can be improved by treatment with alkali to remove the free fatty acids.

The method of separating the fresh oil into its two fractions, solid and liquid, and the possibilities of bleaching each fraction separately are described.

While the product bleached and purified as described, may be regarded as of good quality and having possibilities as a substitute for other locally produced vegetable oils, either for edible purpose or soap-making, such an oil cannot be compared with high grade edible oils as marketed in Europe.

An outline of the complete refining process for a vegetable oil, including a reference to the possibilities of hydrogenation is given.

References.

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 - (2) BOLTON E. R., Oils, Fats and Fatty Foods. Second Edition (1928), page 402.
 - (3) SASTRY S. G., The Catalytic Bleaching of Palm Oil, *Transactions of the Chemical Society*, Vol. CVII, 1915, page 1828.
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Reviews.

The Veterinary Journal.

Vol. 88, No. 10, October, 1932. Publishers: Baillière, Tindall and Cox, 7 and 8 Henrietta St., Covent Gardens, W.C. 2. Price two shillings net or twenty one shillings per annum, post free.

This number is styled "Special Pig Diseases Number" and although the greater portion of the bulletin is devoted to the results of research on diseases, it contains much information on diseases caused by malnutrition. Several articles, which are probably the most interesting to the agriculturist in the tropics, give the latest findings and thought on purely nutrition research.

Some of the General and Clinical articles covering advanced investigations on diseases are written for other veterinary research workers and practitioners, but much of the information in the journal is couched in language that can be followed by the ordinary reader.

The articles on the electro-lethalizer for anaesthetising pigs immediately before slaughter commends a humane method which has been in vogue in Germany and England for some time; it is also claimed to be a better and cheaper method than shooting from the slaughterers' and consumers' point of view.

Electric stunning suggests a method of anaesthetising wild and other troublesome animals, for such operations as can be performed in a short space of time. The reviewer is informed that experiments are proceeding at the Singapore abattoirs with this method of stunning before slaughter.

The article on modern nutritional research, amongst other very interesting statements, gives the results of experiments on the feeding of minerals to farm stock. From the results of previous experiments during the past few years, it has become the custom amongst progressive agriculturists to feed elaborate mineral mixtures to all animals as an insurance against a possible mineral deficiency.

The recent experiments show that under pen conditions in England, the simplest and cheapest minerals, with salt, have given equally as good results as the expensive elaborate mixtures.

This article also gives the findings of modern research into the protein requirements of farm animals and shows how proteins of vegetable origin, with minerals added, can replace those derived from animal origin, e.g. milk, meat, and fish meal.

The paper on nutritional anaemia in suckling pigs throws much light on the frequent losses of piglings in litters in Malaya and the so called "bad doers" in litters.

The authors' investigations have been carried out on the assumption that anaemia in suckling pigs is solely caused by a deficiency of iron salts, or alternatively that certain iron salts, if assimilated by young pigs, will help the animals considerably to overcome the low haemoglobin values. The continuation of the

investigations in endeavours to obtain a simple practical method of administering the iron, showed that pigs allowed in the open and free to root up the earth, or pigs that were given plough earth in the pens, showed haemoglobin values as high as any of the animals treated clinically. This appears to indicate that the anaemia may not be altogether due to a deficiency of iron as it is impossible to state that the young pigs were obtaining iron only from the earth or grazing.

The paper on "Asthenia in Pigling:" gives a finding of mineral deficiency as the cause of heavy mortality in the litters in a herd of swine, the symptoms however showed no indication of anaemia.

An interesting article on tuberculosis in swine states that this disease in pigs is almost invariably of bovine origin, which explains the reason why Malayan pigs are practically free from tuberculosis, as dairying and pig raising are seldom practised on the same holding.

It has been shown in the paper on lungworms that these parasites live a part of their life cycle in the earthworm and the alternative host is essential for the transference of these parasites from one pig to another. Suitable anthelmintics are unknown for lungworms in pigs, and as a means of prevention it is recommended that young pigs should only be grazed on land that has had no pigs on it for two years.

T. D. M. .

Report on Visit to West Indies.

By F. A. Stockdale, C.M.G., C.B.E., Colonial Office, September, 1932.

Mr. F. A. Stockdale, Agricultural Adviser to the Secretary of State for the Colonies in this publication gives a concise account of the activities of the Departments of Agriculture in the West Indies, Bermuda, British Guiana and British Honduras. It is a report of the writer's visit to these colonies undertaken in 1932 to ascertain the present-day conditions of the agricultural industries in the Colonies visited and to study the work being performed by the different Departments of Agriculture to assist these industries.

The Report is of interest to agriculturists in the East by reason of the similarity of crops and of the many agricultural problems discussed which bear a close relationship to those that engage our attention.

Miscellaneous Article.
ENTOMOLOGICAL NOTES.

Fourth Quarter, 1932.

BY

G. H. CORBETT,

Government Entomologist.

Spraying v. Dusting for Leaf-Eating Caterpillars of Coconuts.

In a recent publication*, the writer referred to some preliminary experiments which were being conducted with power dusters for the control of leaf-eating caterpillars of coconuts. Spraying with lead arsenate has proved effective for this purpose when the caterpillars have been confined to young palms and would, if the machinery were available and the roads, drains and nature of the soil permitted its transport, also prove satisfactory against caterpillars on tall palms. Of the estates in Malaya, however, that can afford to purchase the machinery, only a limited number possess roads suitable for transporting it over the clayey or peaty nature of the soil and for negotiating drains. These transport difficulties militate against the control of leaf-eating caterpillars by spraying. Whilst most coconut estates in Malaya are found on flat land, and therefore the transport of heavy machinery over hills would not have to be overcome, the scarcity of water would probably be found the limiting factor on those estates over which the heavy spraying machinery could be transported.

The control of coconut leaf-eating caterpillars can be accomplished by spraying with lead arsenate but consideration has had to be given to the above mentioned difficulties with the result that measures other than spraying have usually been recommended. These have proved generally satisfactory but cannot be stated to have been as effective as a poisonous spray would have been. For instance, the recommendations for the control of *Setora nitens*, consist in encouraging its parasites, especially the Tachinid, *Chaetexorista javana*, and dislodging the caterpillars by brushing them off the leaves with a bamboo pole to which a coconut husk is attached, and, in the case of the caterpillars of *Artona catoxantha* and *Mahasena corbetti*, in grease banding the trunks to prevent the caterpillars which have reached the ground from re-ascending the palms. In considering these difficulties, dusting appeared to be a possible solution and accordingly enquiries were made as to suitable dusting machines capable of throwing a dust to a height of some 50 or 60 feet. As a result a dusting machine† was found to be available in Malaya and steps were taken to obtain it in order that some preliminary experiments in dusting could be conducted.

* Corbett, G. H., "Insects of Coconuts in Malaya", Special Bulletin No. 10, General Series 1932, published by the Department of Agriculture, S.S. and F.M.S., page 76.

† "Dustejecta", Manufactured by Drake and Fletcher, Ltd., Maidstone and kindly lent by the Agents, Messrs. Guthrie and Co., Kuala Lumpur.

*At the outset the writer must state that equally satisfactory dusters may be on the market and that at present he is not in a position to recommend or otherwise the purchase of this or any other duster for the control of leaf-eating caterpillars, because the results of preliminary trials have already revealed that, although dusting has advantages over spraying machinery in so far that the initial cost of the machinery is decidedly less, that to a very large extent the nature of the soil is overcome because the machine can be carried by four coolies and that dusting is not dependent on water, other factors, even though a dusting machine may be capable of throwing a dust to the height of an ordinary coconut palm, have to be considered and surmounted before dusting can be recommended. In this connection, it may be observed that, since most caterpillar pests of coconuts, viz., *Artona*, *Chalcoscelis* and *Setora*, are in the initial stages of attack confined to the oldest leaves, the dust to be effective would not have to be thrown to the height of the youngest leaves.*

The degree of fineness of the dust is an important consideration. In America, manufacturers guarantee that 50-70 per cent. will pass through a sieve having 300 meshes to the square inch. Closely associated with fineness is the lightness of the dust and especially important in Malaya is its dryness. Lead arsenate and calcium arsenate are usually employed as dusts and for dusting are diluted with a filler. Hydrated lime generally serves for this purpose, since it is light, cheap and easily prepared. Sulphur is also used as a carrier when the aim is to control an insect pest as well as a fungus disease. In Malaya, consideration would probably have to be given to this filler in order to control the fungus, *Pestalotzia*, which follows the feeding of the young caterpillars of *Chalcoscelis*. Lead arsenate, as a dust, is generally used in the proportion of 1 to 10 of filler, but whether at this strength the caterpillar pests of coconuts are controlled has not been ascertained, although observations appear to show that the amount of lead arsenate would have to be increased. When the strength has been ascertained, the effective quantity of dust per acre of coconuts has to be found and it is possible that dusting, as a general estate practice, may eventually be proved to be too expensive and may have to be limited to small areas where the damage is excessive and to areas where caterpillars have been found to be numerous, so as to prevent the spread of the moth. Observations undoubtedly indicate that the pests of coconuts are at first confined to small areas and from these foci spread and become generally distributed throughout an estate.

Whilst dusting can be performed quicker than spraying and an attacked area could therefore be covered in less time, it is considered to be less effective than spraying even on trees whose leaves are covered with hairs which assist in retaining the dust. The coconut leaf is smooth, so that, when the leaf is dry, very little dust is held and, though some may be retained, a slight breeze causes it to fall to the ground. Wet leaves do not afford the even distribution of the dust as dry leaves, but in view of the fact that the coconut leaf, when dry, holds but little dust, there would appear to be no alternative but to dust when the

DUSTING COCONUT PALMS.

EXPLANATION OF PLATE.

1. Dust ascending to 40 — 50 feet.
2. Dust descending owing to a top breeze.
3. Wind preventing the dust ascending and causing drift.
4. Dusting from a trolley, showing good distribution.



leaves are damp, although the dust will be inclined to accumulate in spots. The dusting of palms in Malaya after showers has been tried with quite satisfactory results as the leaves have been found to be well covered with dust after a period of three weeks although in the interval 12" of rain had fallen.

Another important factor is wind. It has already been stated that a slight breeze when the coconut leaf is dry causes the dust to fall to the ground. In Malaya, the air is more still at night and in the early morning; during the day time, breezes are general which not only prevent the dust from remaining on the leaves but also from reaching the palms or, by raising it above the tops of the palms, cause it to drift.

It is considered that for dusting to be successful in Malaya the operation would generally have to be performed at night when the air is still and when the leaves are damp, but not heavy with dew, so that on the leaf drying the dust would be retained.

At this juncture it may be said that, given suitable climatic conditions, dusting for the control of leaf-eating caterpillars of coconuts appears to have possibilities, but, until more detailed experiments have been conducted, it would be unwise to recommend it. When opportunity affords, further dusting experiments will be made and the strength and the quantity of the mixture for effective control will be the principal considerations, but such work is dependent not only on the presence of leaf-eating caterpillars of coconuts but also on the cooperation of Managers of Estates.

Departmental.

FROM THE DISTRICTS.

The Weather.

Following a very wet November the month of December has been a dry one by comparison. It is normally a fairly wet month everywhere excepting along the coastal areas of Kedah and Province Wellesley and the coastal tract on the west of Johore. This year, however, rainfall for the month appears to have been below normal throughout the Peninsula. This is perhaps most marked in the case of the east coast. The average precipitation for Kota Bahru for December is 27.49 inches as compared with 13.84 inches recorded for the month under review. Still more marked are the figures for Pekan, in Pahang, where the average for the month on 35 years' records is 28.45 inches as compared with 5.30 inches recorded for December, 1932. This lower precipitation for the month is general and includes the returns from mountain stations as is exemplified in the figures for Cameron Highlands which this December are 3.9 inches as compared with an average monthly precipitation of 11.08 inches, based on 6 years' records. The only instances where returns received exceed the average are Kuala Selangor, 11.46 inches, as compared with an average of 9.01 inches and Johore Bahru, 10.07 inches, as compared with an average for the month of 9.70 inches.

Remarks on Crops.

Rubber.—The price paid for kampong rubber in the various localities shows a slight drop for the month. Price ranges throughout all districts in dollars per picul were 6.00—10.00 for smoked sheet; 5.00—8.40 for unsmoked sheet and 1.00—4.50 for scrap. The corresponding average prices in Singapore for kampong rubber were 9.60 for smoked sheet, \$8.70 for unsmoked sheet and \$4.20 for scrap.

Little change can be reported in the position with regard to Mouldy rot. In the drier areas such as Province Wellesley, the disease is stated to be much less in evidence but, on the other hand, the unsatisfactory condition with regard to control of the disease is emphasised in reports relating to Bandar Bahru and Kulim Districts of Kedah and the Selama and Biah areas in Perak.

No reliable data is available regarding the percentage of small holdings in tapping, but reports indicate that little change has occurred in this respect during the month.

Padi.—The price at the Bagan Serai Rice Mill remained at \$1.80 per picul throughout the month, which is equivalent to 7 cents per gantang and is the same as that reported last month.

Prospects for the coming crop are generally good throughout the Peninsula. In Kedah, a certain amount of flood damage is reported. Thus, in the Kuala Muda District, some 400 acres of newly planted padi was damaged on account of the bund giving way. Similarly, newly planted padi in Kulim was damaged and in the Bandar Bahru District 100 acres of young padi was destroyed, whilst 300 acres were inundated in Kuala Pasu District, 50 acres of which was destroyed. In Province Wellesley, harvesting is in progress in many localities and a good crop is expected. Generally speaking, the floods at the end of November caused little damage, Balik Pulau in Penang being the area most affected. Attacks by the Fulgorid Bug, *Sogata furcifera*, in many parts of the Settlement will doubtless result in some reduction of the crop. In Krian, flowering is generally good throughout Bagan Serai and Biah and has commenced in Gunong Semanggol and Selinjing. In the north east area the crop is making excellent growth. It must be remembered that a fair proportion of padi in north east Krian was planted late and, under such circumstances, a wet harvest may reduce the yield considerably so that the crop harvested may fall short of present expectations for this area. Elsewhere in Perak prospects are good. In Selangor, harvesting was completed in the inland Districts except in the southern part of Ulu Selangor where wet weather and floods have caused much loss of crop to this late planted padi. In the coastal districts transplanting is practically completed. In the Negri Sembilan, harvesting is practically completed in Jelebu, well under way in Seremban, Tampin and Port Dickson Districts and has not been commenced in Kuala Pilah District. In Malacca, harvesting is in progress throughout the Settlement except in some of the coastal mukims, which are always later than the remainder of the Settlement. Crop prospects are generally good in Kelantan, harvesting of short term padi and Tugal padi is in progress and a fair yield is being obtained. Inland areas have suffered to some extent from shortage of water during the month. In Pahang, harvesting is well advanced and yields are reported to be good throughout. As a larger area than usual has been planted this season in Pahang west it is now certain that the crop will prove to be a record one.

In the four districts of west Pahang, investigations indicate that there is an increase of 9,000 acres under padi as compared with last year. In Johore, harvesting is well advanced in Batu Pahat, Muar, Segamat and Kluang. Weather conditions have been suitable in all parts of the State and fair crops are generally expected. Co-operation between the Agricultural and Land officers, coupled with increased interest in the crop shown by cultivators themselves, have resulted in prospects being very much better for padi in Johore than has been the case in the past.

Coconuts.—Further progress in the matter of improvements to kilns and the quality of copra manufactured by small-holders is reported from many parts of the Peninsula. In Province Wellesley, the fact that one Malay owner has received the price ruling for No. 1 grade copra has induced neighbours to follow his example and erect kilns of the pattern recommended by the Department. In

the Bagan Datoh district of Perak there are now over 300 kilns erected and during the month, the Assistant Chemist for Copra Research visited the area to ascertain the present position. Much work is needed to encourage the improvement of many of the kilns erected and consequent improvement of the copra made and to further this object arrangements have been made to send an additional Malay Officer to Bagan Datoh to group the small-holders into suitable units for copra manufacture and to instruct and foster the best methods of manufacture. The Officer selected for this has received training at the Klang Coconut Station in Selangor. In Selangor, progress continues, and there is evidence of improved grouping. Notwithstanding the high price offered for poor copra owing to the keen competition amongst middlemen, the quality of copra made by small-holders continues to show improvement in Sabak Bernam and Kuala Langat Districts. At Batu, in Kuala Langat, a central kiln has been erected by a grower capable of taking the produce from 150 acres and 2 new kilns are under erection at Sabak Bernam. Reports from Pahang state that work has commenced on the construction of a copra kiln at Temerloh, whilst, in Pahang East, Headmen are making efforts to form a combine to deal with copra from an area of 200 acres.

Cloves.—Attention is drawn by the Field Officer in Province Wellesley to the considerable increase in the price of cloves as compared with last month. The respective quotations per picul being \$35 for November and \$50 for December.

Weekly Fairs.

Weekly Fairs have received considerable and varied attention of late in most parts of the country. In Kedah, 33 fairs are now held regularly and some progress has been made towards organising them under a committee. In Selangor many fairs are held but there is evidence that further attention is required with regard to their organisation. In Negri Sembilan there is a good attendance, but the quantity of kampong grown vegetables brought forward for sale is small. In Malacca, two new fairs have been started during the month, whilst it is reported that they are becoming increasingly popular in West Pahang, except in the District of Bentong. The present lack of support in this District may be largely due to the fairs being an innovation and increased support may be forthcoming later. In Johore, fairs have been opened at 5 new centres in the Muar District and in one centre at Batu Pahat.

Agricultural and Padi Experiment Stations and Test Plots.

Agricultural Stations.—Considerable progress was made during the month in the establishment of the Station at Bukit Metarjam in Province Wellesley. The erection of buildings is completed and Carpet grass has been dibbled in on paths and road edges. At the Selama Station 3 good types of arecanut have been planted. At Kuala Kangsar, the work of erecting new fowl houses of

an improved type and renovating the stands for the wire netting enclosure is now practically completed and the poultry area presents a much more business-like and finished appearance than before. It is expected that the new type of fowl house erected will prove more suitable for the climate of Malaya than the old design of house. At Tanah Rata, Cameron Highlands, tea seed of 10 varieties imported from India has been sown and seed of a number of varieties of tobacco has been obtained for trial. Improvements to the tea factory are being carried out and are expected to be completed shortly. At Sungei Udang in Malacca fencing of poultry runs was continued and the erection of fowl houses is completed. At Kuala Lipis Station further plantings have been made of grafted fruit trees and a number of varieties of sugar cane have been introduced for trial. At the Singapore Pineapple Station the close planted areas of pines show better growth than those more widely planted, so much so that the close planting arrangement has been followed by certain Chinese in the vicinity.

Padi Stations and Test Plots.—Reports show that the heavily manured plots in the supplementary manurial trials laid down at the Padi Stations and many of the Test Plots are showing considerably better growth than the controls in nearly every case. Reaping has commenced at Pulau Gadong Station and the crop there is maturing rapidly. Reports indicate that the growth of the plants at practically all the Test Plots is very satisfactory. In a few instances, slight trouble has been experienced in the matter of irrigation control. It is worthy of record that 5 out of the 6 Plots in Johore are in a satisfactory condition. Harvesting was completed on one during the month and is in progress on three others and will shortly commence on the fifth. The unsatisfactory Plot is at Ayer Itam, where the crop was completely spoilt by rats.

DEPARTMENTAL NOTES.

Honour for Dr H. A. Tempany, Director of Agriculture, S.S. & F.M.S.

His Majesty the King has been graciously pleased to confer the honour of Commander of the Most Excellent Order of the British Empire (Civil Division) on Harold Augustin Tempany, D.Sc., F.I.C., Director of Agriculture, S.S. and F.M.S.

Tour of the Director of Agriculture.

Dr. H. A. Tempany, Director of Agriculture, S.S. and F.M.S., accompanied by Mr. F. Birkinshaw, Acting Chief Field Officer, made a tour of Perak and Province Wellesley between the 8th and 13th of December. He visited and inspected all Agricultural Stations, Padi Experiment Stations and Test Plots and conferred with the various Administrative and Agricultural Officer throughout these areas.

Coconut Experiment Station - Klang.

The control of this station was taken over from the Division of Economic Botany by the Agricultural Division of the Department of Agriculture in November.

There are now 50 acres under mature palms on the Station; these include both tall and dwarfs; the three types of the latter which are represented are those with red, green and yellow nuts. Present work is mainly concerned with careful recording of monthly yields of nuts obtained from individual palms throughout the entire area. Since these palms present a collection of desirable types, the records, when taken over a sufficiently long period, will form a basis for selection work with this important crop. In the immature portion of 30 acres, only part of which is planted, a collection of palms raised from nuts obtained by the Agriculturist during a visit to Ceylon are making good progress.

School of Agriculture, Malaya.

The School closed for the holidays on December 22nd and will be reopened on February 1st.

There are at present 30 students in the School.

Progress examinations were held during December, the results of which were, with a few exceptions, satisfactory.

The Field Instructional work during December included the planting of $1\frac{1}{2}$ acres with three clones of budded rubber stumps, obtained from the Rubber Research Institute, the establishment of a germination nursery for selected coconut seed and the limeing and re-planting of the vegetable garden. The students paid a visit to the Experimental Plantation, Serdang, and received instruction in the various activities which were then in progress.

Mr. W. A. Stanton has been appointed a member of the Advisory Committee for the School of Agriculture in place of the late Mr. J. S. Arter.

Visit of Agricultural Field Officer, Singapore, to Labuan and Brunel.

Mr. D. G. P. Olds, Agricultural Field Officer--Singapore visited Labuan and Brunei during the months of November and December for the purpose of inaugurating agricultural services in these two territories in accordance with recommendations made by the Director of Agriculture as a result of his visit in August last. It is proposed to inaugurate small Agricultural Departments in both areas and steps are being taken to recruit and train the necessary Malay staff, while proposals are under consideration for the establishment of a number of small demonstration and test stations.

Leave and Transfers.

The leave of absence granted to Mr. B. Bunting, Agriculturist, has been extended, on medical grounds, for a period of two months from 22nd January, 1933.

Mr. A. E. C. Doscas, officiating as Senior Agricultural Officer, Perak, proceeded on leave of absence on December 24th 1932. Mr. F. R. Mason, Agricultural Field Officer, Province Wellesley and Penang, is replacing him as Senior Agricultural Officer, Perak, while Mr. J. A. Baker is acting as Agricultural Field Officer, Province Wellesley and Penang.

Mr. W. N. Sands returned from leave of absence on January 6th and resumed duty as Principal Agricultural Officer, Kedah.

Mr. J. Fairweather, who officiated as Principal Agricultural Officer, Johore, during the absence on leave of Mr. F. de la Mare Norris, assumed duty as Agricultural Field Officer, Johore North, on 23rd November, 1932.

Statistical.

MARKET PRICES.

December, 1932.

Rubber.—The Singapore price of rubber smoked sheet equal to London Standard in December showed a gradual decline throughout December from 7 7/8 cents to 7 1/16 cents per lb., the average price for the months being 7.54 cents per lb., as compared with 7.75 cents in November. The average London price in December was 2.48d. per lb., and New York 3.20 cents (gold) per lb., as compared with 2.56d. and 3.39 cents (gold) respectively in November.

The average price per lb., in 1932 was as follows :—Singapore 6.97 cents, London 2.39d., New York 3.35 cents (gold) per lb. compared with 9.78 cents, 3.13d., and 6.07 cents (gold) respectively for the year 1931.

Palm Oil.—During the first half of December the market was steady at £18.15.0 per ton; the price dropped to £18 per ton during the latter half of the month, closing at this price with a downward tendency.

The average price for 1932 of cabled quotations c.i.f. Liverpool on a basis of 18 per cent. f.f.a. was £17.16.9 as compared with £18.8.3 for 1931.

Copra.—The market has shewn a decline in prices during the month, Sundried being quoted at \$5.80 per picul at the beginning of the month and \$5.55 at the end of the month. The average price in December for this quality was \$5.72 per picul, as compared with \$5.81 in November: "Mixed" averaged \$5.20 per picul in December as compared with \$5.28 in November.

The average Singapore price of Sundried copra in 1932 was \$5.74 per picul as compared with \$5.09 for 1931. Mixed averaged \$5.22 per picul in 1932 as compared with \$4.64 in 1931.

Coffee.—Singapore prices of Palambang coffee were steady in December, the average price for the month being \$19.90 per picul as compared with \$19.38 in November. The average price in Singapore of Sourabaya coffee was \$22.20 to \$24.50, the price within this range depending upon quality.

The average prices in Singapore for the year 1932 were Palambang \$17.74, Sourabaya \$24.12 per picul.

Arecanuts.—The Singapore average price in December for Palambangs was \$2.65 as compared with \$2.64 in November. Bila Whole averaged \$3 as compared with \$2.81 per picul in November. Average Singapore prices per picul of other grades in December were :—Splits \$4.05 to \$5.95; Red Whole \$4.70 to \$5.46; sliced \$5.45 to \$6.90—Kelantans were unquoted.

The average Singapore prices per picul for arecanuts during the year 1932 were as follows :—Palambang \$3.10, Bila Whole \$3.27, Splits \$6.30, Red Whole \$7.08, Sliced \$10.77, Kelantan Split \$6.44.

Rice.—The average wholesale price of Siam No. 2 ordinary rice per picul in Singapore in November was \$3.79 as compared with \$3.68 in October. No. 1 Rangoon rice averaged \$3.41 per picul in Singapore in November as compared with \$3.41 in October.

The average retail market prices in cents per gantang of No. 2 Siam rice in November were :—Singapore 30, Penang 30, Malacca 27, as compared with 30, 30 and 28 respectively in October.

Gambier.—Prices have fallen still further, Block closing at \$5 and Cube No. 1 to \$9.50 per picul. The average prices for December were Block \$5.20, Cube No. 1 \$9.80 per picul, as compared with \$5.88 and \$10.19 respectively in November.

Average prices per picul in 1932 were Cube No. 1 \$14.73 and Block \$8.24 as compared with \$17.33 and \$10.59 in 1931.

Pineapples.—Supplies of fresh fruit have been scarce resulting in a slight firming of the prices of canned pineapples. Average prices per case in December were Cubes \$3.07, Sliced flat \$2.85, Sliced tall \$3.26 as compared with \$2.95, \$2.84 and \$3.24 respectively in November.

The average prices per case for the year 1932 were as follows :—Cubes \$3.34, Sliced flat \$3.27, Sliced tall \$3.48 as compared with \$3.51, \$3.29 and \$3.49 in 1931.

Tapioca.—Prices have remained practically unchanged, Singapore average prices per picul for December being—Flake, fair \$3.70, Pearl seed \$4.12 and Pearl medium \$4.22, as compared with \$3.32, \$3.98 and \$4.08 respectively in November.

Average Singapore prices for the year 1932 were Flake fair \$3.22, Pearl seed \$4.05, Pearl medium \$4.26, as compared with \$3.60, \$4.67 and \$5.71 in the year 1931.

Sago.—The average Singapore prices per picul in December were :—Pearl small, fair \$3.98, Flour, Sarawak, fair \$2.15 as compared with \$4.07 and \$2.29 respectively in November.

The demand in December was uncertain, Eastern Ports requirements at one time caused an advance in prices which, however, were not maintained.

The Singapore average prices picul for the year 1932 were as follows :—Pearl, small fair \$4.24, Flour, Sarawak, fair \$2.24 as compared with \$5.01 and \$2.34 respectively in 1931.

Mace and Nutmegs.—The Singapore market has been dull with little enquiry. Prices are more or less nominal for mace, Siouw being quoted throughout the month at \$62 per picul and Amboina at \$40.

Average prices for nutmegs in December were :—110 per lb. \$25.20 per picul, 80 per lb. \$30.60 per picul as compared with \$23.75 and \$29.50 per picul in previous month.

Average prices per picul for the year 1932 were as follows :—Mace. Siouw \$59.37, Amboina \$41.59. Nutmegs 110 per lb. \$24.84, 80 per lb. \$30.29.

Pepper.—The market has been quiet with importers generally not pressing sales. Average Singapore prices per picul in December were :—Singapore black \$17.25, Singapore White \$21.65, Muntok white \$22.15 as compared with \$17.25, \$22.44 and \$22.94 in November.

Average Singapore prices per picul for the year 1932 were :—Singapore black \$19.64, Singapore White \$25.07, Muntok White \$25.61.

Cloves.—Market featureless nominal prices being quoted at Zanzibar \$40 and Amboina \$45.

Average Singapore quotations during 1932 (monthly nominal prices were) Zanzibar \$43.75, Amboina \$47.19.

The above prices are based on London and Singapore daily quotations for rubber; on the Singapore Chamber of Commerce Weekly Reports for the month and on other local sources of information. Palm oil reports are kindly supplied by Messrs. Cumberbatch & Co., Ltd., Kuala Lumpur, and the Singapore prices for coffee and arecanuts by the Lianqui Trading Company of Singapore.

1 picul = 133½ lbs. The Dollar is fixed at two shillings and four pence.

Note.—The Department of Agriculture will be pleased to assist planters in finding a market for agricultural produce. Similar assistance is also offered by the Malayan Information Agency, 57, Charing Cross, London, S.W.1.

GENERAL RICE SUMMARY*

November, 1932.

Malaya.—Gross foreign imports of rice (including stocks available for re-export) during November, 1932, amounted to 52,474 tons as compared with 50,109 tons in November, 1931, of which 44.9 per cent. were consigned to Singapore, 19.7 per cent. to Penang, 9.7 per cent. to Malacca, 19.3 per cent. to the Federated Malay States and 6.4 per cent. to the Unfederated Malay States.

Of these imports 58.6 per cent. were from Siam, 37.4 per cent. from Burma, 2.8 per cent. from Indo-China and 1.2 per cent. from other countries.

Total foreign exports of rice from Malaya in November, 1932, were as follows (in tons):—

Siam rice 11,464, Burma rice 5,161, Indo-China rice 753, Indian rice 10, local production rice 165: Total 17,553 tons.

Of these exports 84.1 per cent. went to the Netherlands East Indies and 15.9 per cent. to other countries.

The exports during November 1931 were 15,815 tons.

Net imports for the period January to November, 1932, were 370,105 tons as compared with 480,970 tons for the same period of 1931, a fall of 23.1 per cent.

India and Burma.—Total foreign exports of rice (*Indian Trade Journal* 8.12.32) during October, 1932, were 72,000 tons as compared with 144,000 tons in September, 1932, and 135,000 tons in October, 1931, decreases of 50.0 per cent. in respect of the previous month and 46.7 per cent. in respect of the same period of the previous year.

Total exports during period January to October, 1932, were 1,866,000 tons as compared with 1,806,000 tons for the corresponding period of 1931, an increase of 60,000 tons or 3.3 per cent.

Total exports of rice and bran from Burma for the period January 1 to December 3, 1932, amounted to 2,894,313 tons as compared with 3,344,463 tons for the corresponding period of 1931, or a decrease of 13.5 per cent.

Quotations at Rangoon on 30.11.32 for white rice of 100 baskets of 75 lbs. each were Rs. 180 for Big Mills Specials and Rs. 185 for Small Mills Specials as compared with Rs. 186 and Rs. 198 on 2.11.32 and Rs. 213 and Rs. 233 on 2.12.31.

The Third Forecast of the Rice Crop in Burma for the season 1932-33 issued on December 15, 1932, gives the area likely to mature as 12,257,700 acres, being 167,400 acres or 1.4 per cent. more than the final figures of last year.

The estimated outturn (states the Forecast) is 7,444,200 tons of padi which is 796,200 tons or 12.0 per cent. more than the corresponding estimate of the previous season.

* Abridged from the Rice Summary for November 1932, compiled by the Department of Statistics S.S. and F.M.S.

The years' exportable surplus is estimated at 4,662,000 tons of padi which may be taken as equivalent to 3,450,000 tons of rice and rice products.

Japan.—According to the second rice-crop forecast for 1932, (*Trans-Pacific Journal*, dated November 17, 1932) the yield is estimated to be 8,440,180 tons, a decrease of 2.2 per cent. from the first crop forecast and an increase of 9.0 per cent. over the actual crop of 1931.

Siam.—Exports (approximate) of rice from Bangkok during November, 1932, amounted to 135,908 tons as compared with 98,679 tons in November, 1931, or an increase of 37.7 per cent.

Exports of rice from Bangkok during the period December, 1931, to November, 1932, (the figures for August to November, 1932, being approximate) amounted to 1,505,412 tons, an increase of 319,796 tons or 27.0 per cent. as compared with the same period of 1930-31.

At the end of October, 1932, (Principal Trade Commissioner, Ministry of Commerce and Communications, Bangkok) the area under padi in 60 provinces amounted to 7,308,000 acres, an increase of 252,000 acres or 3.6 per cent. as compared with the same period of 1931.

Netherlands India.—*Java and Madura*. The *Korte Berichten* of November 25, 1932, states that at the end of October, 1932, the area harvested amounted to 8,650,250 acres, an increase of 393,750 acres or 4.8 per cent. as compared with the same period of 1931, the area damaged to 348,042 acres a decrease of 118,785 acres or 25.4 per cent. as compared with 1931 and additional plantings awaiting harvesting to 1,018,500 acres a decrease of 54,250 acres as compared with 1931, a total of 10,016,792 acres as compared with 9,796,076 acres for the same period of 1931 an increase of 2.3 per cent.

Imports of rice into Java and Madura during January to October, 1932, totalled 122,244 tons as compared with 243,751 tons for the same period of 1931, or a fall of 49.8 per cent.

Imports of rice into Outer Provinces during January to September, 1932, totalled 192,829 tons as compared with 246,492 tons for the same period of 1931 or a fall of 21.8 per cent.

French Indo-China.—Entries of padi at the port of Cholon from January 1, 1932, to November 30, 1932, amounted to 1,048,934 (metric) tons, an increase of 18,188 tons or 1.8 per cent. as compared with the same period of 1931.

Exports of rice from Saigon for the period January 1, 1932, to November 30, 1932, amounted to 1,090,497 (metric) tons, an increase of 192,936 tons or 21.5 per cent. as compared with the same period of 1931.

Ceylon.—Imports for 10 months October 31, 1932, were 371,819 tons, an increase of 4,835 tons or 1.3 per cent. as compared with 1931.

Of these imports 20.4 per cent. were from British India, 69.3 per cent. from Burma, 0.4 per cent. from the Straits Settlements and 9.9 per cent. from other countries.

Europe and America.—Quantities of rice shipped from the East were :—

- (a) To Europe period January 1 to November 24, 1932, 948,430 tons as compared with 1,026,938 tons for the same period of 1931, a decrease of 7.7 per cent. Of the 1932 shipments 52.6 per cent. was from Burma, 2.4 per cent. from Japan, 36.9 per cent. from Saigon, 5.3 per cent. from Siam and 2.8 per cent. from Bengal, as compared with 57.6 per cent. from Burma, 7.1 per cent. from Japan, 27.6 per cent. from Saigon, 5.4 per cent. from Siam and 2.3 per cent. from Bengal in 1931.
- (b) To the Levant, period January 1 to October 17, 1932, 47,145 tons, a decrease of 13,355 tons or 23.3 per cent. as compared with the same period of 1931.
- (c) To the West Indies and America, period January 1 to October 22, 1932, 114,740 tons, a decrease of 20,040 tons or 14.9 per cent. as compared with the same period of 1931.

INTERNATIONAL GROCERS' EXHIBITION, 1932.

The International Grocers' Exhibition, which opened on September 17th and closed on September 23rd, was held, as usual, in the Agricultural Hall, Islington, London.

The Malaya Stand was situated at the extreme end of one side of the Empire Marketing Board section.

Apart from the exhibits on the Malayan stand, a section of the "Empire Shop-Window" was allotted, in which was set a good range of Malayan products suitable to the occasion.

A very attractive display was made of Malayan tinned pineapple in its various packings and labellings. Only "Golden Quality" was displayed. Tins were kept open on the counter to enable visitors to sample the contents, and the comments made on both the colour and the flavour were very favourable. Liaison was effected between the importing firms and a large number of distributors who hitherto had stocked only the produce of competing countries, and it is understood that much satisfactory business has accrued, or is in process of accruing, as the direct result.

In addition, the stand displayed some really good Malayan tapioca and sago. Hitherto the Malayan exhibits staged at exhibitions had always been under the handicap of only having available tapioca of a dark colour and inferior appearance generally. The samples provided this time, however, were white and well graded; experts pronounced them equal to, if not better than, the Netherlands Indian products, and there was the great advantage that they were considerably lower in price. Genuine business inquiries were received from a large number of well-known firms.

MALAYAN AGRICULTURAL EXPORTS, NOVEMBER, 1932.

PRODUCT.	NET EXPORT IN TONS.				
	Year 1931	Jan-Nov. 1931	Jan-Nov. 1932	Novem- ber 1931	Novem- ber 1932
Arecanuts ...	19,266	17,553	18,549	1,440	2,428
Coconuts fresh ...	10,468	8,565	200,588†	1,416	9,981†
Coconut oil ...	9,909	9,035	10,649	906	1,437
Copra ...	100,809	90,999	90,690	11,419	12,543
Gambier, all kinds ...	2,563	2,398	2,771	195	225
Palm kernels ...	726	644	1,098	90	125
Palm oil ...	4,574	3,925	7,300	460	1,010
Pineapples Canned ...	59,457	52,287	60,510	3,160	3,807
Rubber § ...	434,857	395,020	376,163	38,612	34,031
Sago—flour ...	5,608	4,081	9,293	2,080	1,815
„ —pearl ...	2,429	2,213	2,953	338	237
„ —raw ...	2,904*	2,053*	3,833*	295*	503*
Tapioca—flake ...	9,742	8,889	8,346	653	500
„ —flour ...	491*	410*	88	143*	220
„ —pearl ...	19,006	17,130	18,567	1,194	2,003
Tuba root ...	74	63	114‡	15	9

† '000 in number.

* net imports.

§ Production.

ACREAGE OF TAPPABLE RUBBER OUT OF TAPPING IN
NETHERLANDS INDIA AT END OCTOBER, 1932.

	A Totally Ceased		B Partly Ceased		Total A & B	
	Estates	Area in Acres	Estate	Area in Acres	Estates	Area in Acres
Java and Madura ...	190	104,036	49	12,315	239	116,351
Outer Provinces ...	207	89,396	61	30,539	268	119,935
Total Netherlands India ...	397	193,432	110	42,854	507	236,286

The total area out of tapping for the month of October amounts to 25 per cent. of the total tappable area as at end of December, 1931.

**ACREAGE OF TAPPABLE RUBBER OUT OF TAPPING ON ESTATES OF 100
ACRES AND OVER, MALAYA, AT THE END OF NOVEMBER, 1932.**

STATE OR TERRITORY (1)	Acreage of Tappable Rubber end 1931 (2)	ESTATES WHICH HAVE ENTIRELY CEASED TAPPING		ESTATES WHICH HAVE PARTLY CEASED TAPPING		Total (3) + (5) (7)	Percentage of (7) to (2) (8)
		Acreage (3)	Percentage of (3) to (2) (4)	Acreage (5)	Percentage of (5) to (2) (6)		
FEDERATED MALAY STATES :—							
Perak	238,420	14,662	6.1	31,806	13.3	46,468	19.5
Selangor	294,030	17,984	6.1	37,376	12.7	55,360	18.8
Negri Sembilan	217,002	18,851	8.7	21,756	10.0	40,607	18.7
Pahang	35,122	8,122	23.1	3,979	11.3	12,101	34.4
Total F.M.S. ...	784,574	59,619	7.6	94,917	12.1	154,536	19.7
STRAITS SETTLEMENTS :—							
Province Wellesley	44,055	2,336	5.3	8,937	20.3	11,273	25.6
Dindings	6,700	310	4.6	1,139	17.0	1,449	21.6
Malacca	110,288	5,201	4.7	21,693	19.7	26,894	24.4
Penang Island	1,585	776	48.9	236	14.9	1,012	63.8
Singapore Island	28,033	13,014	46.4	3,999	14.3	17,013	60.7
Total S.S. ...	190,661	21,637	11.3	36,004	18.9	57,641	30.2
UNFEDERATED MALAY STATES :—							
Johore	313,385	41,874	13.4	35,312	11.3	77,186	24.6
Kedah (a)	114,254	11,114	9.7	7,112	6.2	18,226	16.0
Kelantan	16,785	5,666	33.8	1,417	8.4	7,083	42.2
Trengganu (b)	4,300	Nil	Nil	2,072	48.2	2,072	48.2
Perlis	903	106	11.7	462	51.2	568	62.9
Total U.M.S. ...	449,627	58,760	13.1	46,375	10.3	105,135	23.4
TOTAL MALAYA ...	1,424,862	140,016	9.8	177,296	12.4	317,312	22.3

Notes :—1. (a) Registered companies only and are rendered quarterly, commencing with June 1931.

(b) Registered Companies only.

The above table together with a Summary was prepared and published by the Statistics Department, S.S.
and F.M.S. on October 26, 1932.

MALAYA RUBBER STATISTICS
TABLE I
STOCKS, PRODUCTION, IMPORTS AND EXPORTS OF RUBBER, INCLUDING LATEX, CONCENTRATED LATEX AND REVENUE.
FOR THE MONTH OF NOVEMBER, 1932 IN DRY TONS.

Territory	Stocks at beginning of month 1			Production by Estates of less than 100 acres and over		Production by Estates of 100 acres and over		Imports		Exports including re-exports				Stocks at end of month				
	Ports	Dealers	Estates of 100 acres and over	during the month	during the month	during the month	during the month	during the year 1932	Foreign	Local	Foreign	Local	Foreign	Local	Ports	Dealers		
				1932	1932	1932	1932	1932	1932	1932	1932	1932	1932	1932	1932	1932		
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
MALAY STATES:—																		
Federation of Malaya																		
States	...	15,039	11,709	10,909	127,578	6,847	83,289	Nil	Nil	Nil	Nil	13,307	5,290	150,731	64,259	...	13,927	11,958
Johore	...	2,831	3,027	3,477	39,997	3,837	38,575	Nil	5	Nil	69	1,002	6,340	10,767	67,878	...	2,751	3,084
Kedah	...	735	1,999	2,213	24,797	1,233	10,718	Nil	Nil	Nil	Nil	643	2,767	7,273	28,029	...	825	1,995
Perlis	...	32	12	8	74	14	72	Nil	Nil	Nil	Nil	19	Nil	133	...	...	34	13
Kelantan	...	176	151	153	1,594	575	2,861	28	Nil	422	Nil	48	538	4,145	...	...	250	164
Trengganu	...	55	50	100	1,135	50	569	Nil	Nil	Nil	Nil	150	Nil	1,704	...	...	55	50
Total Malay States	...	18,868	16,948	16,860	195,172	12,706	136,092	28	5	422	69	15,000	15,187	166,336	166,148	...	17,842	17,264
SELTAM																		
Malacca	...	3,609	1,361	1,377	14,852	...	...	Nil	Nil	Nil	Nil	4,187	...	44,941	...	...	4,339	1,315
Province Wellesley	...	120	646	469	4,935	...	...	Nil	Nil	Nil	166,336	...	...	...	...	...	192	652
Dindings	...	99	76	90	1,000	...	...	Nil	15,223	Nil	...	5,015	...	56,770	...	...	67	68
Penang	...	655	4,286	11	4	30	...	468	4,431	...	...	...	...	...	...	1,150	4,492	15
Singapore	...	3,786	18,156	215	143	1,675	...	7,218	60,063	...	...	15,896	...	167,954	...	3,624	20,314	207
Total Straits Settlements	...	4,441	26,270	2,369	2,083	22,432	2,482	22,404	7,686	15,223	64,494	25,098	Nil	258,505	Nil	4,674	29,404	2,257
TOTAL MALAYA	...	4,441	45,138	19,257	13,943	217,667	15,088	158,496	7,714	15,228	64,916	40,098	15,187	43,134	166,148	4,674	47,246	19,521

TABLE II
DEALERS' STOCKS IN DRY TONS

Class of Rubber	Federated Malay States	S'pore	Penang	Province Wellesley	Johore	Total
20	21	22	23	24	25	26
DRY RUBBER	11,102	17,918	3,906	4,344	974	38,244
WET RUBBER	2,825	2,396	536	254	1,777	7,338
TOTAL	13,927	20,314	4,442	4,598	2,751	46,032

TABLE III
FOREIGN EXPORTS

PORTS	For month	during the year 1932
Singapore	...	25,893
Penang	...	8,159
Port Swettenham	...	5,237
Malacca	...	754
MALAYA	...	40,098

TABLE IV
DOMESTIC EXPORTS

AREA	For month	during the year 1932
Malay States	...	32,490
Straits Settlements	...	37,846
MALAYA	...	32,490

Notes.—1. Stocks on estates of less than 100 acres and stocks in transit on rail, road or local steamer are not ascertained.

2. The production of estates of less than 100 acres is estimated from the formula: Production + Imports + Stocks at beginning of month = Exports + Stocks at end of month, + Consumption, i.e., Columns [1] + [14] + [17] + [18] + [19] + [19A]—[2]—[3]—[4]—[5]—[9]—[10]. For the Straits Settlements, Columns [7] and [8] represent purchases by dealers from local estates of less than 100 acres, reduced by 15% to terms of dry rubber.

3. Dealers' stocks in the Federated Malay States are reduced to dry weights by the following fixed ratios: unsmoked sheet, 15%; wet sheet, 25%; scrap, lump, etc., 40%; stocks elsewhere are in dry weights as reported by the dealers themselves.

4. Domestic stocks are estimated by the formula: Domestic stocks at beginning of month + Imports + Exports + Stocks at end of month = Domestic stocks at end of month. For the Federated Malay States, being under a period of 2 months from the gross foreign exports of the later month, the foreign exports of the Malay States being under a period of 2 months from the gross foreign exports of the later month, the foreign exports of the Federated Malay States are estimated by the Registrar-General of Statistics, S.S. and F.M.S., at Singapore on 21st October, 1932.

METEOROLOGICAL SUMMARY, MALAYA, NOVEMBER, 1932.

Locality	AIR TEMPERATURE IN DEGREES FAHRENHEIT					EARTH TEMPERATURE		RAINFALL						BRIGHT SUNSHINE					
	Means of		Mean of A and B	Absolute Extremes				At 1 foot	At 4 feet	Total		Most in a day	Number of days				Total	Daily Mean	Per cent
	A.	B.		Min.	Max.	Lowest	Highest						Precipitation .01 in or more	Thunder-storm	Fog morning obs.	Gale force 8 or more			
		°F	°F	°F	°F	°F	°F	°F	°F	in.	mm.	in.	in.	23	23	6	2	hr.	hr.
Railway Hill, Kuala Lumpur, Selangor	88.6	72.2	80.4	93	71	80	74	82.9	84.1	15.53	394.5	4.07	23	23	6	2	131.70	4.39	37
Bukit Jeram, Selangor	85.6	72.1	78.9	88	70	75	74	82.9	84.7	12.96	329.2	1.98	22	19			161.20	5.37	45
Sitiawan, Perak	87.0	72.9	79.9	91	71	78	75	82.8	84.2	13.30	337.8	4.08	25	20	2		156.90	5.23	44
Kroh, Perak	83.9	69.7	76.8	88	67	76	72	79.6	81.2	17.37	441.2	2.95	27	24	5	3	124.30	4.14	35
Temerloh, Pahang	87.1	72.7	79.9	91	71	79	75	83.5	84.9	15.36	390.1	3.34	25	22	1	8	129.20	4.31	36
Kuala Lipis, Pahang	87.1	71.4	79.3	91	70	82	73	82.6	83.7	9.52	241.8	1.85	26	22	3	21	145.85	4.86	41
Kuala Pahang, Pahang	85.3	73.2	79.3	91	71	79	75	82.9	84.6	12.36	313.9	3.59	23	13	3		157.15	5.24	44
Mount Faber, Singapore	86.1	73.4	79.7	90	71	78	76	81.4	82.7	4.51	114.6	1.14	15	9	2	3	168.75	5.63	47
Butterworth, Province Wellesley	84.8	73.4	79.1	87	72	78	75	82.6	84.2	17.81	452.4	8.22	24	19	2	1	154.90	5.16	44
Bukit China, Malacca	83.6	72.7	78.1	86	71	80	76	81.5	83.2	13.06	331.7	2.25	26	19	1		164.15	5.47	46
Kluang, Johore	86.8	71.4	79.1	90	70	78	73	81.3	82.1	12.65	321.3	3.75	22	17	1	7	129.70	4.32	36
Bukit Lalane, Mersing, Johore	85.4	71.7	78.5	91	70	79	73	80.5	81.3	14.02	356.1	2.50	24	21	3		126.40	4.21	35
Alor Star, Kedah	85.3	73.7	79.5	89	72	79	76	83.3	84.9	12.59	319.8	2.65	20	17	6	2	155.70	5.19	44
Kota Bahru, Kelantan	84.9	73.1	79.0	88	71	77	75	82.9	84.2	20.97	532.6	5.06	23	20			151.85	5.06	43
Kuala Trengganu, Trengganu	84.5	72.1	78.3	88	71	78	74	80.6	82.5	32.51	825.8	6.39	24	23	1		178.30	5.94	50
HILL STATIONS.																			
Fraser's Hill, Pahang 4268 ft.	71.6	61.3	66.5	76	60	65	63	70.5	71.1	15.52	394.2	2.89	26	24	4	8	81.65	2.72	23
Pahang Cameron Highlands, Tanah Rata, Pahang 4750 ft.	70.0	59.0	64.5	74	55	64	61	69.2	69.2	15.36	390.1	1.63	30	26	1	10	82.45	2.75	23
Cameron Highlands, Rhododendron Hill, Pahang 5120 ft.	69.5	58.9	64.2	74	57	62	60			15.84	402.3	1.62	29	24		4	87.70	2.92	25

Compiled from Returns supplied by the Meteorological Branch, Malaya.

JUST PUBLISHED IN THE TAMIL LANGUAGE.

THE CULTIVATION OF ALLOTMENTS

BY

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Assistant Agriculturist

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EDITORIAL

Fruit Production Survey in Malacca.

The article entitled "A Survey of Fruit Production in Malacca Territory" which is included in this number, gives an account of the first occasion on which the survey method has been applied systematically to the investigation of the general status of a minor agricultural peasant industry in Malaya.

The conclusion arrived at from casual observation of small fruit holdings in Malaya, that the majority of peasant cultivators plant fruit with the primary object of supplying their own household requirements and that their methods of culture and marketing are highly primitive is substantiated by the findings of the survey in Malacca, where only 37.6 per cent. of the 154 fruit holdings observed throughout the territory, made a practice of selling their produce.

An estimate of the annual revenue from one acre planted with durian, jack fruit, rambutan, bananas and pineapple, based on average figures obtained from the survey and with conservative yields and prices, shows that a profit of \$82.10 per acre should be obtainable and since the average size of the fruit holdings under observation was 3.3 acres, it would appear that, theoretically, if all the fruit were sold, an income of approximately \$240/- per holding, per annum, might be expected.

An important factor in the marketing problem is that of the indebtedness of the grower to shop-keepers or money lenders. The survey discloses the fact that 23 per cent. of the owners of the 159 small-holdings are in debt and that frequently their entire produce passes into the hands of their creditors.

Although this survey cannot be said to bring to light any information on fruit cultural practices which might be of general benefit, it does, however, elucidate a considerable amount of interesting information on the present conditions of the industry in Malacca.

The success of this method of investigation may be said to justify fully its application in the future over a wider field.

There are, at the present time, in Malaya considerably more than 50,000 acres under fruit cultivation, exclusive of the many small kampong plots of interplanted trees. In consideration of this figure, the sum of approximately two and a half million dollars, which represents the total value of all fruit, fresh

dried and preserved imported into the country during 1931, seems disproportionately high.

Although many of the imported fruits are such as cannot be grown in Malaya, one feels that with an improvement in methods of cultivation, systematic grading and packing and better organised marketing, the local demand for Malayan produce would increase considerably, fresh fruit of good quality being more popular than that which is dried or otherwise preserved.

In spite of the facilities for transport in the Peninsula, it frequently happens that the distribution system becomes disorganised, as for example in the month of June of 1932, when in Province Wellesley and Penang there was a glut of durian and mangosteen which overloaded the local markets to such an extent that much of the fruit was unsaleable, while at the same time in Kedah these fruits were only beginning to appear on the market and in the Negri Sembilan the durian crop was poor and mangosteen had not ripened.

In order to obviate the possibility of such contingencies occurring in the future, contingencies which do much to discourage the grower from personal enterprise, it would appear desirable that some intelligence system should be organised, based on a more intimate knowledge of the factors governing the fruit industry, whereby information as to fruit prospects in different localities might be made available to some central organisation by which distribution and sale could be arranged on co-operative lines.

Insect Pests of Tobacco in Malaya.

This article is the third to appear in consecutive numbers of the *Malayan Agricultural Journal* on the subject of tobacco cultivation in Malaya. Since the depredation of insects is one of the most difficult of the problems which beset the cultivation of this crop, a recognition and a knowledge of the methods of control of tobacco pests should prove of considerable interest to growers, more especially when the increasingly large areas now being planted are certain to cause correlative incidence of the insects which prey upon the crop.

The caterpillars of certain varieties of moths are the most serious of the pests which attack the tobacco plant. Ten of the types more commonly met with are described in detail in this article together with lists of their alternative host plants. This information, together with a knowledge of the fungoid and bacterial diseases of tobacco, is of great value in the planning of a crop rotation for areas in which it is intended to cultivate tobacco.

Since natural enemies of tobacco pests have not been frequently observed, it follows that artificial control measures are of the utmost importance, and without an understanding of the habits of any agricultural pests no such measures can be effectively carried out.

The factor of the combating of pests should be borne in mind by the prospective large scale grower, for an equal amount of attention must be given to this problem in a large as in a small area and it is obvious that the labour required for such measures as the hand picking of caterpillars would, in anything but a market garden plot, be very considerable.

Original Articles.

A SURVEY OF FRUIT PRODUCTION IN MALACCA TERRITORY.

BY

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Singapore.

Introduction.

Until quite recent years, the only methods available for investigating the state of an agricultural industry or part of an industry were the well known Cost Accounting and Financial Accounting methods: Such methods were universally employed although recognised as unwieldy, costly and of doubtful accuracy.

It is not proposed here to describe these methods in detail, but, in essence, they consist of making detailed and lengthy costings of the different sources of income for a particular industry, treating any information emanating from the producer as of no value, and relying almost entirely on the capability of the particular person or persons engaged in the investigation to estimate such items as the residual value of manures, depreciation of stock etc.

These methods, though accurate enough for many industries, must necessarily fail to produce a true picture of the case when applied to agriculture, where it is almost impossible to apportion true values to the many contributing factors. Moreover, the method necessarily meant a detailed examination of each unit of production, so that the process of investigating a whole industry was an extremely laborious one, and the results seldom justified the amount of energy and time expended.

The Survey Method.

The appearance of what is now known as the Survey Method has led to a very decided change in the field of agricultural research. Emanating originally, it is believed, from America, the method was studied by research workers in England, and has been tested in different parts of the world. It is now in common use by the Agricultural Economic Research Institute of Oxford University and has been usefully employed in examining various industries such as dairy and mixed farming in England, the cocoa industry of Trinidad, cocoa and other industries in the Gold Coast and the sisal industry of East Africa.

The method adopts as its basic principle that, in any one industry which has been in existence for a number of years, there must be a number of esta-

blished practices which are of definite value to that industry and which are the result of accumulated experience. That is to say, the producer is in possession of certain facts which, if extracted and correlated in a reasonable order, will be of value to others.

In practice, a large number of units of production, whether small holdings, farms, or estates, are selected for study. The number is large enough to permit of its being split up into groups of units which show similar characteristics, such as those of soil, climate, rainfall, distance from market, methods of production and prices obtained. The information required for the survey is obtained by personal visits to the holdings under survey and is supplied by the producer himself. For the purpose of making records which are capable of being subjected to rapid and accurate analysis, the investigator employs a field-form or questionnaire, drawn up to suit the problem in hand, and tried out on several holding experimentally previous to the commencement of the survey. It will depend upon the nature of the problems to be investigated, the type of producer met with and the amount of information available, as to whether the actual field questionnaire is used in the field or whether rough notes are to be made and afterwards entered up on the field form.

The information extracted by the above methods is collected and analysed. It will soon become evident to the investigator that certain methods of production are in use amongst certain groups and different methods amongst others. Further detailed examination of the field forms will give an idea of the economic success or otherwise of these groups. If one group is financially sound, and another group is not, and, except for one factor, the conditions in both groups are the same, it is evident that the unsuccessful group can be advised to follow the methods employed by the other. In other words, sound economic agricultural practices are revealed by the analysis and these practices are then described and recommended to producers who are employing non-economic methods. Such, in brief, is the outline of the Survey Method.

In the tropics one meets with very different conditions from those obtaining in temperate lands. Agricultural methods are more primitive, the standard of education is lower and the spirit of competition is less keen. As a comparatively rapid method of studying conditions in a branch of an industry in the tropics, however, the method is to be recommended, since it places on record a number of facts which call attention to the urgent needs of that industry.

In order to test the applicability of the method and to gain information regarding a valuable native industry, a survey of fruit production by the peasant was undertaken by the writer, in Malacca Territory. The staff employed was the existing staff of the Department of Agriculture in that area, and although the Officers concerned had no experience of work of this kind, the results obtained were definitely encouraging.

Methods Employed.

Malacca Territory is divided into three administrative districts, Central,

Alor Gajah and Jasin, each of which has a Malay Agricultural Assistant in charge. After instruction in the objects and methods of the investigation, each assistant was supplied with a number of field survey sheets, which had been found to be suitable. A total of 154 holdings was surveyed, this being equivalent to two holdings per mukim. The field-form employed is designed to give information regarding the average number of trees, yield, source, and price of planting material, place of sale and price obtained, of each of the forty fruits listed. In addition, there are columns for information regarding the owner himself, his name, nationality, whether indebted and if so to whom, as well as the size, situation, soil, aspect, and distance from town or market, of his holding.

In practice it was found that information regarding yields was difficult to obtain and producers exhibited a certain reluctance in disclosing their financial status. These constituted the two chief difficulties encountered throughout the survey.

Re-surveys were performed by the writer from time to time in order to check the work of the assistants and it was found that the information was reasonably accurate.

In addition to the above, two holdings which appeared to be better than the average, were surveyed in detail, actual counts of the number of trees present being made, accurate yield figures taken and all other relevant information recorded. From these figures it was possible to obtain a fairly accurate estimate of the amount of income from a good fruit holding in bearing.

A further investigation into market prices and "kampong" prices was also made.

Results.

The information obtained in the Survey may be classed under two headings as follows :—

1. Information which was obtained as a result of observation and personal inspection during the field work.

- (a) Fruit growing, to a greater or less extent, is practically universal amongst Malays.
- (b) Fruit production on Malay holdings is in a primitive state.
- (c) The practice of "marcotting" is fairly common amongst Malays.
- (d) Chinese holdings are almost invariably in a more flourishing condition than Malay holdings.
- (e) Chinese holdings in Malacca are not owned for money-making purposes, but for family consumption.
- (f) Fruit production amongst Malays has increased since the decline in rubber prices. The fruit, however, is usually grown for home consumption purposes.
- (g) Marketing methods leave much to be desired since they place the producer in the hands of the middleman, who is usually a Chinese. The fruit sold locally in the Kampong commands a very low price and the producer is usually in the hands of the shop-owner.

- (h) The unit of production is very small, and this militates against the producer's bargaining power.
- (i) No attempt at co-operative sale or marketing was met with during the investigation.
- (j) Fruit grown by Malays is grown primarily for home consumption. Any surplus above the amount required in the household is at very low prices.
- (k) A common Malay method of treatment for fruit trees is to allow secondary jungle to develop under the trees and to cut it back during the fruiting season.
- (l) Planting methods are extremely primitive.
- (m) Much damage to fruit trees is occasioned by squirrels and flying foxes. Very little attempt at combatting these pests is ever made by the Malay.
- (n) Serious damage by diseases appears to be rare.
- (o) Chinese holdings where regular spacing is adopted, good planting material used, manuring performed and adequate supervision provided, give much better yields than holdings not so treated.
- (p) Malays will admit that it is possible to obtain a fair profit from fruit, but appear to be ignorant of methods of good husbandry.
- (q) The practice of "letting" certain high yielding trees in a holding to more industrious Malays or to Chinese, is fairly common amongst Malay owners.

2. Information which was obtained from the field forms used.

See Tables 1, 2, 3 and 4.

Analysis of the completed field sheets gave information on the following points :—

- (i) The percentage of holdings on which manuring was practised.
- (ii) The percentage of occupiers in debt.
- (iii) The average acreage of all holdings surveyed.
- (iv) The percentage of holdings for which planting material had been purchased.
- (v) The most common fruits grown in Malacca.
- (vi) The percentage of holdings from which fruit was sold.
- (vii) The average price obtained in the kampong for the commoner fruits.
- (viii) The average prices obtained in the market for each of the common fruits in Central, Alor Gajah and Jasin Districts of Malacca.

TABLE I.
Information Obtained from Field Sheets.

District.	Column 1. Percentage of holdings on which manuring is attempted. per cent.	Column 2. Percentage of owners or occupiers in debt. per cent.	Column 3. Average acreage of holdings.	Column 4. Percentage of holdings on which planting material was bought. per cent.	Column 5. Percentage of holdings from which fruit is sold. per cent.
Central	13	25	3.42	27	30
Alor Gajah	25	23	2.50	18	43
Jasin	29	20	4.34	16	40
Average	22.5	23	3.3	21	37.6

TABLE II.
The Ten Commonest Fruit in Malacca.

Name of Fruit.	No. of holdings on which represented. (Total number of holdings 154)
Coconut ...	153
Rambutan ...	126
Durian ...	123
Banana ...	116
Mangosteen ...	112
Jack Fruit ...	97
Langsat ...	93
Bachang ...	82
Rambai ...	79
Mango ...	67

Discussion of above results.

(i) From Table 1 column (i) will be seen that on 22.5 per cent. of the holdings surveyed some attempt at manuring was made. Usually this was of a very primitive kind but the figure serves to illustrate the extent to which the cultivators realise the need for enriching the soil for fruit growing. Often the manure consisted of cut grass and small undergrowth placed round the base of the trees and allowed to rot, while in other cases cattle and pig manure was deposited around the roots. In many cases, manuring was carried out primarily for the growth of vegetables which were planted under the fruit trees.

(ii) Column 2 Table 1 shows that approximately one quarter of the number of cultivators were in debt at the time of the survey. They were indebted, almost invariably, to Chinese shop keepers and to Chettiars. The extent of their indebtedness was not, in most cases, investigated, but usually debts were large enough to ensure that the debtor sold all his produce to or through his creditor, thereby placing himself in the hands of the latter. This figure of 25 per cent. is almost certainly below the true figure since many holders would not admit debt and all doubtful cases were recorded as "not in debt". The figure is, however, high enough to indicate the urgent need for reform in this direction.

(iii) Column 3 table 1 gives the average acreage of the 154 holdings surveyed as 3.3 acres and is probably quite an accurate figure. The general opinion of many producers was that anything less than 5 acres was too small a unit for profitable fruit production, but as will be seen later, this is probably not the case.

(iv) The percentage of holdings for which planting materials had been bought, is given in Column 4, table 1 as 21 per cent. This figure is surprisingly high, considering the primitive state of the industry. The planting material bought consisted of coconuts and chiku marcots from selected local fruit holdings, and rambutan seedlings from Penang. The extent to which the Malay is prepared to import fruit planting material from outside his district is illuminating and points to the need for providing adequate supplies of these stocks for him at reasonable prices.

(v) Table 1 Column 4, gives the percentage of holdings from which fruit was sold. The amount sold was usually very small and represented the surplus above that needed for home consumption. Many complaints of the unjust treatment the producer received at the hands of the shop keepers were met with, but in all fairness it must be stated that often the low prices obtained were due to the smallness of the amount of fruit available, its poor quality (since the best was usually consumed in the household) and the irregularity of the supply. No attempt at grading or co-operative sale was met with.

(vi) Table 2 gives a list of the 10 commonest fruits in Malacca as judged by the frequency of their occurrence in the holdings. Coconuts are practically universal, but for the most part the palms are old and poor yielding and attempts at improving either the yield or the quality of the product were rare.

Rambutan and durian are very popular as a native fruit and find a ready sale during the season. Durian trees are often "let" to other Malays or to Chinese during the fruit season. Bananas are popular because they offer a more or less constant supply of food and a little cash to the owners, but are usually of inferior quality, considered from a European stand point. One rather surprising figure is that for the mango. The fruit is liked both by European and natives if of good quality but this is so variable a factor that the question of improvement by growing only selected stocks is an important one. The same applies to a greater or less extent to most of the fruit trees in Table 2.

TABLE III.
Kampong and Market Prices of Fruit.

Name of Fruit.	Av. Kampong Price.	Av. Market Price
Coconut ...	1—2 cts. each	2—3 cts. each
Rambutan ...	5—10 cts. per 100	15—20 cts. per 100
Durian ...	3—6 cts. each	5—10 cts. each
Banana ...	90 cts. to \$1.60 per picul	90—\$2 per picul
Mangosteen ...	10—15 cts. per 100	20—30 cts. per 100
Jack Fruit ...	20—30 cts. each	30—45 cts. each
Langsat ...	8—10 cts. per gantang	15—20 cts. per gantang
Bachang ...	1—1 ct. each	1—2 cts. each
Rambai ...	2—3 cts. per gantang	5—8 cts. per gantang
Mango ...	1½—2½ cts. per 10	4—5 cts. per 10

(vii) Table 3 indicates the difference between the average kampong prices and and market prices. These figures indicate that there is a large discrepancy. The presence of two, three, or even more middlemen between the producer and the consumer is largely responsible for this discrepancy. The fruit may be passed from the holding to a shop keeper, from a shop keeper to a lorry owner, from a lorry owner to another shop keeper by whom it is sold. Such a process naturally reflects on the prices obtained.

On the figures given in the field sheets and with low yields and prices, as a basis, an estimate is given below of the amount of revenue it would be possible for a producer to obtain from a fruit holding where all the fruit is sold. The holding is a theoretical one, built up from figures actually determined in the field and represents what could be done without any special trouble or care on the part of the producer.

¼ acre Durian	= 6 trees @ 40 feet x 40 feet planting distance.
¼ „ Jack Fruit	= 12 „ „ 30 „ x 30 „ „ „
¼ „ Rambutan	= 9 „ „ 35 „ x 35 „ „ „
⅛ „ Bananas	= 54 „ „ 10 „ x 10 „ „ „
⅛ „ Sarawak Pineapple	= 218 plants @ 5 „ x 5 „ „ „

Durian, 6 trees yielding 70 fruits per tree per annum @ 6 cts. each = \$25.20

Jack Fruit, 12 trees yielding 6 fruits per tree per annum @ 30 cts. each
= \$21.60

Rambutan, 9 trees yielding 600 fruits per tree per annum @ 15 cts.
per 100 = \$ 8.10

Bananas, 54 trees yielding 1 bunch per tree per annum @ 10 cts. per
bunch = \$ 5.40

Sarawak pine, 218 plants yielding 1 fruit per plant per annum @ 10 cts.
per fruit = \$21.80

Total = \$82.10

The total income from this holding of 1 acre is, then, \$82.10. Since the average size of holding in Malacca is over 3 acres, one can therefore assume that the average producer, were he to sell all his fruit, would obtain, as a minimum, approximately \$240.00 from his holding per annum. The probability is that he could obtain much more with a little care.

The above theoretical holding could, of course be planted up with a greater variety of types of fruit, with advantage, but the foregoing figures serve to illustrate the possibilities of fruit growing for the Asiatic small-holder.

The above estimate of income from a theoretical holding was made prior to a detailed survey of two good holdings. Since that time, it has been possible to obtain actual figures for yield from two such holdings and it is of interest to note that the theoretical estimate approximates fairly closely to the results, from an actual holding. One of the holdings surveyed in detail was somewhat immature but the estimated value of yield from it was \$155.00 while the other holding, which was in actual bearing, gave an estimated income of \$342.00—an average for the two of \$228.00.

It would appear, therefore, that the survey method, in addition to having supplied certain information of value, is sufficiently accurate for the purposes of actual investigation.

(viii) Table iv gives the market prices of a large number of fruits in the three Districts, Central, Alor Gajah and Jasin, and affords an interesting comparison with the kampong prices. There is obviously an urgent need for reform in marketing methods.

Conclusions.

The following conclusions may be drawn from the information collected during the Survey:—

1. Fruit growing as at present practised by the peasant is a primitive industry. No attempt at large scale production is made and general agricultural methods leave much to be desired.
2. The marketing of the produce is not at all satisfactory for the following reasons.—
 - (i) The fruit is not grown primarily for the market but for home consumption.
 - (ii) The indebtedness of the producer to shop-keepers and money lenders.
 - (iii) The ignorance of the small-holder of better methods of husbandry.
 - (iv) The smallness of the unit of production does not allow of adequate bargaining power on the part of the producer.
 - (v) The presence of an excessive number of middlemen between the producer and the consumer tends to lower the selling price and increase the buying price.
3. There is definitely a local market for many Malayan fruits provided they are of good quality.

TABLE IV.

Market Prices for all Fruit in various Districts.

Fruit.	Price in Alor Gajah.	Price in Jasin District.	Price in Central District.
Coconut ...	2 cts. each	2½—3 cts. per fruit	2—3 cts. per 10
Mangosteen ...	4½ cts. per 10	4—5 cts. per 10	2—3 cts. per 10
Rambutan ...	15 cts. per 100		15—20 cts. per 100
Chiku ...	5 cts. per 100	1—2 cts. per fruit.	
Banana ...	12 cts. per bunch	10—30 cts. per bunch	90—\$2 per picul
Duku ...			
Pomelo ...			
Orange ...			
Lime ...		1 ct. per 6 fruits	
Pulasan ...	25 cts. per 100		20—25 cts. per 100
Papaya ...			
Pincapple ...	2 cts. each	15 cts. each Sarawak	15—25 cts. each
		1—2 cts. each ordinary	1—1½ cts. each
Durian ...	6 cts. each	5—13 cts. each	5—10 cts. each
Jack Fruit ...	25 cts. each	1 ct. per slice of 2—3 pulps	40—45 cts. each 15—20 cts. per gantang
Langsat ...			
Belimbing Saji ...			
Belimbing Buloh ...			
Rambai ...			5—8 cts. per gant.
Bachang ...	1½ cts. each	1 ct. per fruit	1—2 cts. each
Rokam ...		2 cts. per 30 fruits	
Durian Belanda ...	5 cts. each	5—6 cts. each	5—6 cts. each
Jambu Biji ...			
Jambu Ayer ...		3 cts. per 30 fruits	10—15 cts. per 100
Ramai ...			10—15 cts. per gant.
Nona ...	3 cts. each		20—30 cts. per gant.
Chermai ...			
Binjai ...	2 cts. each		7—10 cts. per 10
Lanjot ...			
Champedak ...	6 cts. each		8—10 cts. each
Sukon ...			
Jering ...	4—5 cts per 50		10—15 cts. per 100
Mata Kuching ...	\$5 per picul		
Mango ...			4—5 cts. per 10
Petai ...	5 cts. per 10 pieces		15—20 cts. per 100

4. Few Malays seem to consider fruit production seriously as a source of revenue, but in a few cases, always when the producer appeared to be more enlightened than the average, attempts have been made at better agricultural methods, with encouraging results.

5. The present time is admirably suited to propaganda and instruction on fruit growing, owing to the fact that rubber cultivation is unremunerative.

6. The survey method of investigation has proved itself to be satisfactory.

No common practices of great value have emerged from it, so that the necessity for dividing up the number of holdings into groups does not arise. The information collected serves to illustrate the primitiveness of the industry and the need for improvement. The income possible from a holding of three acres is a point that may be noted and those cultivators who are doubtful as to the possibilities of fruit growing should find this information useful in a practical way. A fairly accurate picture of the state of the industry has been obtained in a comparatively short space of time and a number of ways in which reform might be effected can be clearly seen.

Suggestions for the Improvement of the Industry.

- (1) Good planting material at low prices should be made available to cultivators at reasonable prices.
- (2) Instruction in fruit production methods should be part of the course in School Gardens.
- (3) In conjunction with the Cooperative and Administrative Departments, an attempt at solving the problem of the indebtedness of the producer should be made.
- (4) Attention is drawn to the need for improved marketing systems, whether by co-operative or Government financed shops or stalls, or other methods.
- (5) Instruction in packing and grading methods should be given to the peasant.
- (6) The possibilities of extending the markets for local fruits overseas need investigation.

In conclusion the writer would like to thank the Agricultural Field Officer, Malacca for his assistance and cooperation in the carrying out of the Field work.

INSECT PESTS OF TOBACCO IN MALAYA.

BY

N. C. E. MILLER,

Assistant Entomologist.

Introduction.

In every part of the world where tobacco is cultivated, planters have to contend with numerous pests, principally moths (Lepidoptera). Many of these are found in most parts of the world and attack a number of plants.

Insects attacking tobacco in Malaya belong to the Orders grasshoppers (ORTHOPTERA), sucking bugs (HEMIPTERA), moths (LEPIDOPTERA) and ants (HYMENOPTERA). Of these, the most important in Malaya is the Order LEPIDOPTERA.

The caterpillars of the moths fall into the categories of leaf or seed pod feeders, stem borers, and cut-worms, so called from their habit of biting through the stem of a plant at ground level, thereby causing it to collapse.

The Orthoptera which attack tobacco in Malaya are represented by *Atractomorpha crenulata* F. (Acrididae, Pyrgomorphinæ), a moderately slender insect from three quarters to one inch in length, having a green or greenish brown head and body, green forewings and pinkish hindwings. It is not a serious pest.

Two Hemiptera only, (Capsidæ),—*Dicyphus* sp. and *Engytatus volucer* Kock, have so far been recorded.

These are very small insects, which, in the larval and adult stages suck the sap from the leaves and stems.

Engytatus volucer is suspected of being a cause of "leaf curl" (crinkle). It would appear, however, that leaves of plants grown on poor soil are more susceptible to this form of malformation, especially when the bugs are numerous and consequently are causing extensive mechanical injury by their sucking and injection of saliva.

This species has not so far been found in great numbers in Malaya.

Only one member of the Hymenoptera, an ant *Solenopsis* sp. is frequently troublesome, in that it carries away to its nest freshly sown seed.

This paper is based on the results of direct observations made by the writer and on notes made by various members of the Division of Entomology, Department of Agriculture, S.S. and F.M.S.

Descriptions.

Prodenia litura F. (Figs. 15, 16, 17).

The eggs of this species are deposited in groups on the leaves of the food-plant, and are covered by the female with a quantity of buff coloured hairs from her abdomen.

On hatching, the caterpillars are blackish green. For a few days they live gregariously, then separate to feed singly on the leaves.

They measure when full grown about 2 in. in length, and have then, interrupted longitudinal yellow stripes and brownish crescent shaped markings on the back, also a dark brown spot on the first and near the last abdominal segment.

The caterpillar stage lasts for about three weeks. Pupation takes place in the soil, and roughly a week elapses before the emergence of the moth.

The moth measures from one and a half, to one and a three fifths inches across the forewings, of which the pattern is a complicated mixture of whitish yellow stripes, black spots and shading, and shades of bluish grey. The hindwings are white and somewhat iridescent.

This species feeds on a great number of different food-plants, besides tobacco, among which may be mentioned, cotton, groundnut, maize, tomato, potato, castor, banana, beans and rice.

Agrotis ypsilon Rott. (Figs. 18, 19, 20).

This species, commonly known as the "greasy cutworm", is widespread in its distribution, and its caterpillar is almost an omnivorous feeder.

Among the plants sought out by this insect for food are grasses, lettuce, maize and cotton. It has, moreover, been reported as feeding on almost every kind of cultivated plant.

Egg-laying takes place on the leaves of the food-plant, the eggs taking, as a rule, three days to hatch.

The caterpillar stage lasts twenty-six days, then the caterpillar, if it has fed on grass, constructs a cocoon of grass and silk, but when it has fed on other plants, the rule is for it to enter the soil and make a cocoon of earth and silk.

When full grown, the caterpillar measures about two and one third inches in length, and is greyish or brownish with some black spots on the sides and back. The under surface is somewhat paler.

Feeding takes place at night, and during the daytime, the caterpillar conceals itself in the soil or among debris at the base of the food-plant.

After eight or nine days in the pupal stage, the adult moth emerges. It measures one and three quarters of an inch in expanse, with ashy brown forewings having irregular black markings, and whitish hindwings with smoky margins.

Chloridea (Heliothis) obsoleta F. (Figs. 10, 11, 12).

The caterpillar of this species feeds both on the leaves and the buds of the tobacco plant, as well as the petals and seeds.

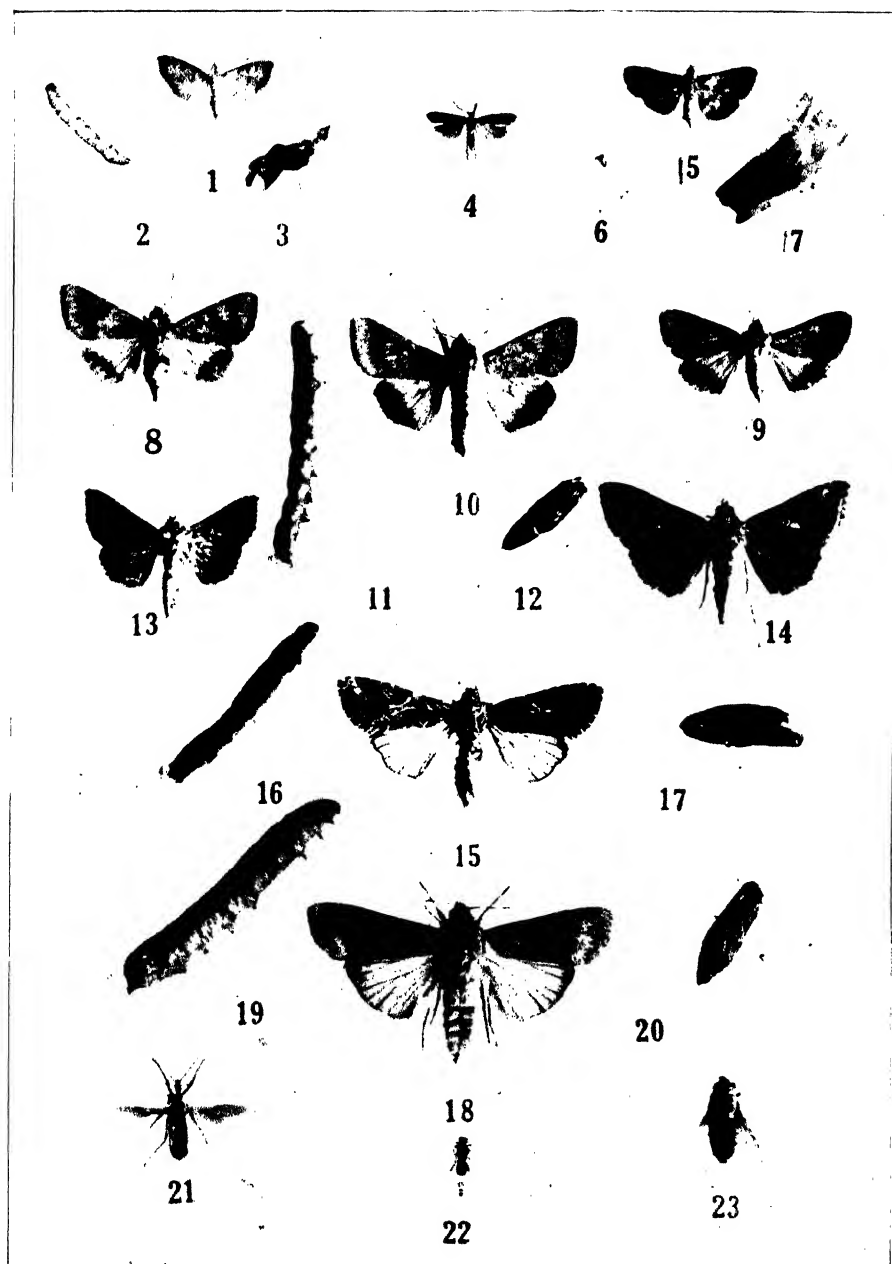
When the time for pupation arrives, it enters the soil and prepares a flimsy cocoon therein.

The caterpillar is brown or greenish with paler longitudinal stripes. When full grown it is about one and a half inches long.

The moth is yellowish brown, with reddish or yellowish transverse narrow stripes on the forewings.

EXPLANATION OF PLATE.

- Fig. 1 *Psara submarginalis* Swinh. adult.
" 2 *Psara submarginalis* Swinh. caterpillar.
" 3 *Psara submarginalis* Swinh. cocoon.
" 4 *Phthorimaea heliopa* Low. adult.
" 5 *Lamprosema diemenalis* Guen. adult.
" 6 *Apanteles inquisitor* Wilkn. adult.
" 7 *Lamprosema diemenalis* Guen. cocoon.
" 8 *Chloridea (Heliothis) flavigera* Hamps. adult.
" 9 *Chloridea (Heliothis) assulta* Guen. adult.
" 10 *Chloridea (Heliothis) obsoleta* F. adult.
" 11 *Chloridea (Heliothis) obsoleta* F. caterpillar.
" 12 *Chloridea (Heliothis) obsoleta* F. chrysalis.
" 13 *Plusia signata* F. adult.
" 14 *Plusia chalcites* Esp. adult.
" 15 *Prodenia litura* F. adult.
" 16 *Prodenia litura* F. caterpillar.
" 17 *Prodenia litura* F. chrysalis.
" 18 *Agrotis ypsilon* Rott. adult.
" 19 *Agrotis ypsilon* Rott. caterpillar.
" 20 *Agrotis ypsilon* Rott. chrysalis.
" 21 *Cosmolestes picticeps* Sta. adult.
" 22 *Chelonus* sp. adult.
" 23 *Podomyia setosa* Dol. adult.



Tobacco, although eaten by this insect, is not its favourite foodplant, maize being more commonly attacked. It will, however, attack cotton, castor, rice and some other plants.

The duration of the pupal stage is twelve days.

Chloridea (Heliothis) assulta Guen. (Fig. 9).

A leaf feeder and rather a serious pest. The caterpillar is green with a yellowish green head, and with small black spots along the sides of the body.

In the field, the caterpillars of this species injure tobacco plants by eating holes, varying from one half to one inch across, in the leaves. The only alternative food-plant, as far as one has been able to ascertain, is groundnut.

Pupation takes place in the soil in a lightly constructed cocoon.

There is a close resemblance between the adult of this species and that of the next species *H. flavigera*.

It measures just over 1 inch across the wings. The forewings are brownish yellow with a broad and somewhat diffuse transverse band near the outer margin and with fine irregular transverse brownish lines. The hindwings are pale brownish yellow with a broad blackish band near the outer margin.

The moth is in the pupal stage from seven to eight days.

Chloridea (Heliothis) flavigera Hamps. (Fig. 8).

Seed pods and leaves are attacked by this species. A certain amount of colour variation is met with in the caterpillar, which may be dark green, paler green with rows of black spots along the sides, or it may be brown.

Each type of caterpillar has longitudinal stripes of darker colour than the rest of the body.

A light cocoon is constructed in the soil by the caterpillar when about to pupate. Roughly ten days elapse before the emergence of the adult.

As previously stated the adult moth is very similar in colouration to *H. assulta*.

This species appears to feed exclusively on tobacco.

Plusia chalcites Esp. (Fig. 14).

The caterpillar of this species feeds on the leaves, the edges of which it draws together by means of silk. It differs considerably from the caterpillar of the species previously referred to, in that the body increases in size towards the posterior end. In colour it is green with narrow longitudinal white stripes along the back.

Cotton, maize, tomato, certain leguminous plants, cucumber, cabbage, potato and turnip are attacked by this species.

Pupation takes place among the folded leaves, and the pupal stage lasts about ten days.

The adult moth is a handsome insect having large brassy patches and two ovate silvery spots on the forewings. The hindwings are of a dull smoky colour.

Plusia signata F. (Fig. 13).

Large holes are made in the leaves by the caterpillar of this species when feeding. When full grown, it measures about one inch in length. It is green with a darker green stripe along the back. The head is yellowish green. A few short hairs are present on the head and body.

Besides tobacco, it has also been recorded as feeding on onion.

To some extent, the adult of this species resembles the adult of *P. chalcites*, but it is much smaller, and the metallic areas on the forewings are dull and less extensive. It measures about one inch across the forewings.

Phthorimaea heliopa Low. (Fig. 4).

This species deposits its eggs singly on the leaf, frequently at the sides of the midrib and cross veins. They are dark buff in colour and are extremely small.

Soon after emergence from the egg, the caterpillar bores into the tissue of a tobacco leaf frequently near the place where the egg was laid. If the egg was laid on a stem, that part of the plant is bored.

Sometimes, when boring the leaf tissue the larva makes holes in it, in which case it usually leaves the tissue and makes a fresh tunnel in a leaf vein.

When full grown, the larva is about a quarter of an inch in length and is whitish in colour with a shining black head. It spins a light cocoon of silk close to the entrance of the tunnel previously gnawed by it in the stem, in which to pupate. This species is almost exclusively a tobacco feeder.

The chrysalis is somewhat slender, and is light brown. It measures a quarter of an inch in length.

The holes made in the leaf base or in the stem, although small, are conspicuous, since, shortly after having been made the edge turns black, and the surrounding area becomes brown.

The injury inflicted by the caterpillar usually gives rise to a gall-like formation on the plant.

The adult is the smallest of the species under consideration. It measures about half an inch across the forewings which are light brown. The hindwings are smoky and have a very broad fringe.

Psara submarginalis Swinh. (Figs. 1, 2, 3).

Owing to the habit of the caterpillar of this species eating away the upper and lower epidermis of a leaf, it may reasonably be called a "leaf skeletoniser".

The egg is small, rather soft and yellow.

The caterpillar is greenish with a shining black head on which is a pale yellow stripe. When full grown the colour of its body changes to pale yellow.

Lettuce, cabbage and jerusalem artichoke have also been recorded as food-plants.

Pupation takes place among the folded leaves which the caterpillar has drawn together with silk, and the pupal stage lasts seven days.

The adult moth measures about three fifths of an inch across. It is pale yellow with irregular greyish purple spots and lines, and with a broad purplish grey area along the front and outer margins of the forewings, and on the outer margin of the hind wings.

Lamprosema diemenalis Guen. (Figs. 5, 7).

Another species, the caterpillars of which feed on the shoots and leaves which they draw together with a silken web. The colour of the caterpillar is grey above and green below, and the head is yellowish.

It pupates among the folded leaves, and the pupal period is from six to eight days.

The moth is brown with irregular yellow markings, and measures three quarters of an inch across.

Several species of cover crops are eaten by the caterpillar.

Control of Tobacco Pests.

Both the Orthoptera and Hemiptera referred to are best controlled by capturing with a handnet or with the hand and then destroyed.

Cutworms may be effectively controlled by poison baits and by hand collecting. The bait for use against them consists of Paris green and bran mixed in the proportions of 1 lb. of the former to 50 lbs. of the latter. It should be prepared with just sufficient water to moisten it, and it should be broadcast at the rate of 10 lbs., dry weight, to the acre.

In preparing the poison bait, the bran and Paris green should be thoroughly mixed dry in a barrel or other receptacle, and then water should be added gradually until the whole is moistened.

The distribution of the bait should be done in the evening a day or two before planting out.

In the event of an outbreak of cutworms some days after planting, the same bait may be used, but it should be scattered around each plant.

Poultry and domestic stock should be prevented from feeding over an area where bait has been distributed.

Cutworms feed almost exclusively at night, and in the day-time, hide themselves among the soil or humus at the base of the plants on which they are feeding, or among herbage in the vicinity.

Hand-collecting should be, therefore, carried out after dark, when the cutworms have left their hiding places in order to feed.

A useful protective device against these insects, which is also recommended, is the use of small tins, (such as cigarettes are usually packed in) from which the bottoms have been removed, in which the plants should be placed, when they are planted out.

As an added protection, poison bait may be placed around the outsides of the tins.

Against leaf-feeders, a stomach poison must be used. This should be applied to the plants in the form of a spray, the poison recommended being lead arsenate.

The proportion of lead arsenate to water to make this spray is 1 lb. to 50 gals., if powder is used, or $1\frac{1}{2}$ to 2 lbs., if paste is used. A stronger mixture is liable to scorch the leaves.

Dusting with this chemical in its powder form is also a useful method of control. For this process the lead arsenate powder is mixed with an equal quantity of dry wood ashes, and then spread over the plants by means of a duster, care being taken that the distribution is even.

Alternatively tapioca flour or slaked lime may be used instead of wood ashes.

The materials should be mixed in the proportions of 4 lbs. of lead arsenate powder to 4 lbs. of wood ashes, and the total quantity spread over 1 acre.

A stomach poison should also be used against the caterpillars of those species which feed in the buds, and, as a supplementary remedy, bran or fine meal mixed with lead arsenate and dropped into the centre of the buds, preferably after rain, is recommended.

The proportions in which this bait is mixed are 1 lb. of lead arsenate powder to 75 lbs. of meal.

In order to prevent infestation by pests when the tobacco is in the nursery, the beds should be covered with muslin at night.

When planting out is complete and no further use is going to be made of any plants which remain in the nursery, they should be destroyed by burning or by burying deeply in the soil.

After harvest, tobacco stalks should be cut down and destroyed to prevent their being foci of further infestation.

The stem borer *Phthorimea heliopa* is possibly the most difficult to control. The caterpillar, however, sometimes bores into the leaf tissue, in which it makes holes, and then makes a fresh tunnel in a leaf vein. In so doing it exposes itself to control by spraying or dusting with lead arsenate, since it is obliged to consume part of the external surface of a vein in order to re-enter it.

A more drastic method of dealing with this stem borer, is to slit the stem with a clean sharp knife and then to remove and destroy the caterpillar living therein.

For the control of ants in seedbeds, suggestions have been put forward that the beds be isolated by means of trenches or trays filled with water or kerosene. This method does not appear to be practicable.

It is desirable to search for the nests of ants, and when found, to destroy the inhabitants by pouring in boiling water or a disinfectant.

Mixing the seed with powdered naphthaline when sowing is effective in repelling ants.

The use of kerosene in the form of an emulsion for spraying the seedbeds, or for mixing alone with the soil when the seedbeds are being prepared, is recommended as an alternative measure.

The latter method consists of mixing with kerosene sufficient soil to cover the seedbed to a depth of an inch or so, then spreading on top of this, the soil in which the seeds are to be sown. The soil after mixing with kerosene should be more or less friable.

Another method which is effective as a trap for ants is to place around the seedbeds, portions of candle nut which has a strong attraction for these insects. Each day the portions of nut should be drenched with boiling water to destroy the ants on them. This is quite a cheap method, and need be employed only up to the time when seeds have started to germinate, at which stage, ants are no longer troublesome.

I am indebted to a local gentleman who has had considerable experience in tobacco planting, for this information.

Natural Enemies.

Natural enemies of the species described herein, either parasites or predators, have not frequently come under notice.

The Reduviid bug, *Cosmolestes picticeps* Sta. (Fig. 21) has been recorded as attacking caterpillars of *Chloridea flavigera*, and of *Psara submarginalis*.

This bug is a moderately large and conspicuous insect, and is frequently to be seen on the wing. In colour it is yellow with a good deal of black on the head and legs. When flying it appears to be entirely yellow.

The caterpillars of *Prodenia litura* are parasitised by a Braconid—*Chelonus* sp.,—(Fig. 22) and by the Tachinid fly—*Podomyia setosa* Dol., (Fig. 23), and the caterpillars of *Lamprosema diemenalis* by the Braconid—*Apanteles inquisitor* Wilk. (Fig. 6).

Podomyia setosa is a fly of the "blow fly" type, and is entirely grey with darker grey markings. The eyes are red.

Chelonus sp. and *Apanteles inquisitor* are inconspicuous insects and are hardly likely to be noticed in the field.

Review.

Oilseeds and Vegetable Oils.

Compiled in the Statistics and Intelligence Branch of the Empire Marketing Board September, 1932. 66 pp. H. M. Stationery Office, Kingsway, London, W.C. 2, price 6d. net (postage extra.)

This book is a summary of figures of production and trade relating to copra, groundnuts, cotton seed, linseed, olive oil, soya beans, sesame seed, rapeseed, palm kernels, palm oil and whale oil. We enumerate the products under consideration as we are informed that this list by no means exhausts the number of plants and seeds which yield oil upon a commercial scale. The inclusion of whale oil is justified as it competes with vegetable oils for various purposes.

As far as is practicable this publication treats each of these products under the following heads: area, world production, world export, importance of export trade, distribution of export, the British Empire as a unit, importing countries, United Kingdom imports and prices.

Two points of great importance emerge from a consideration of the facts stated in this book. Firstly, the very great importance of China as a producer of a number of oil-bearing products. The position regarding oil seed production is somewhat obscured by the absence of reliable data from this principal producer.

The second point is the fact that in most cases, the producing country is the most important consuming country. For instance, we are reminded that "United States, India and China export only a very small proportion of their cotton seed, India and China export respectively about 23 per cent. and 6 per cent. of their groundnuts; while China's exports of soya beans, including oil, represent no more than 21 per cent. of the estimated total production." "The world's exports of palm oil represent less than 25 per cent. of total production and estimates of domestic consumption of coconut oil indicate that only about 60 per cent. of the world's coconuts are exported from producing countries in the form of copra and coconut oil."

It is perhaps but natural that the country of production should have found a number of local uses for an oil obtained locally. An interesting feature of such local consumption, however, is that in many cases the use to which producing countries put their oil is dissimilar to the uses found for it in importing countries. As evidence of this may be instanced palm oil in Africa which is used locally for culinary purposes, coconut oil in India and other countries of production, used largely as a lubricant as well as for culinary purposes and as a illuminant.

The large number of oils available in quantity and the fact that for many commercial purposes they are interchangeable, has resulted in the trend of prices of any one oil being influenced by the quantities and prices of other oils. Producers cannot afford, therefore, to consider their product as standing in a

class by itself, but must study its relation to other oils with which it competes. The publication before us, being a concise statement of production and prices, is a valuable basis from which to study the future prospects of any particular vegetable oil.

D. H. G.

Examination of Latex Samples by the Rubber Research Institute of Malaya.

The attention of managers of rubber estates is invited to a decision of the Board of the Rubber Research Institute of Malaya that as from the 1st February, 1933, fees as under will be charged :

for the determination of D.R.C. of latex \$5/- per sample

for the determination of NH_3 content of latex \$5/- per sample.

Managers will no doubt welcome an explanation of this action by the Board. The operations involved in the determination of D.R.C. and NH_3 have been fully described in Information Cards nos. 18c, 19c and 23c issued by the Institute and also in Section H of Planting Manual no. 4. Moreover, the officers of the Chemical Division have offered and are still willing to give personal tuition to any planter who wishes to be instructed in the technique.

The operations can be easily learned and it is hoped that managers will, by undertaking their own analyses, relieve the officers of the Institute. With this end in view it has been decided to examine free of charge all latex samples sent by an estate during an initial period of one month, after which the fees stated above will be charged.

A. SHARPLES,

Acting Director Rubber Research Institute, Malaya.

Abstract.

THE USE OF DERRIS IN THE CONTROL OF WARBLE FLIES.*

The work was undertaken to ascertain whether the treatment of cattle over a large area to destroy all the warble larvae in the backs of the animals would be effective in eradicating the warble flies.

Investigations in America and the United Kingdom on the most effective method of destroying the warble fly larvae in the backs of cattle have shown that a derris powder wash composed of 1 lb. derris powder, $\frac{1}{4}$ lb. soft soap, 1 gallon of water gives the most satisfactory results.

The results of systematic treatment in four demonstration areas are given. In the first, in North Wales, it was found that 91.9 per cent. of the cattle were infested, with an average of 14.2 warbles per animal. The result of one year's treatment with derris wash was to reduce the warbles to an average of 2.2 per animal with only half the animals infested. In the following year (1931), after again dressing all animals with the derris wash, the warbles per animal were reduced to 0.77, while only 22.8 per cent. of the animals were infested.

The second demonstration was designed to test whether an inland valley could be cleared of warble flies without re-infestation from farms on the other side of the mountains or hills. The satisfactory result was to reduce infestation from 79.3 per cent. of the cattle with 11.7 warbles per animal in 1931 to 15 per cent. of the cattle with an average of 0.72 warbles per animal in 1932.

Somewhat similar satisfactory results were obtained in the other two demonstration areas; the third area being an upland plateau and the other a lowland district.

From these results and the knowledge gained of the habits of the warble fly "it would appear that many farmers, owing to the topological situation of the farms, can be obtain a considerable reduction in the infestation of warbles on their cattle, even if they alone are treating their cattle. In other instances, small groups of farmers who occupy the farms on an inland valley or an upland plateau, or similar area of land, with natural boundaries, can by co-operative effort obtain very appreciable results. In low-lying flat districts, the area to be treated would have to be correspondingly larger if significant results are to be obtained, but even here, since the warble fly apparently does not travel any considerable distance, the united effort of a few farmers owning large farms would considerably reduce the warble fly population of the district".

For the treating of a few animals, perhaps purchased after the herd had been treated, the use of a derris wash might appear troublesome. It was found,

* Abstract of "Extensive work on the Control of Warble Flies" by W. M. Davies and E. Jones, published in the Journal of the Ministry of Agriculture, Vol. XXXIX, No. 9, December, 1932.

however, that dry derris powder rubbed into the backs of animals was nearly as effective as the use of a wash. The value of dry powder for the destruction of lice on cattle enhances this method of application.

In order to ascertain if an appreciable reduction in the cost of treatment could be effected, another tropical plant, cuba root, was tested in a strength which would make its cost comparable with the use of derris. At this strength, although over 95 per cent. kill was obtained under special treatment, variable results were obtained under ordinary farm treatment. Cuba root, in the critical tests, proved just as effective as derris powder when applied at the same strength. At this strength, however, there would be no reduction in the cost.

The above abstract provides a valuable proof of the effectiveness of derris root in the eradication of warble flies in cattle. Derris is a product of Malaya, and is not, as many suppose, collected from our forests. It is cultivated on estates where every care is taken to ensure that only varieties with a high toxicity are grown.

Work on this subject has engaged the attention of the Department of Agriculture, S.S. & F.M.S. for some time, with the result that greater knowledge is accumulating regarding the toxic content of varieties. A disturbing factor, however, is that the toxic content varies not only in different varieties, but also according to the district in which it is grown. The increasing knowledge which is accumulating in this country of origin of the toxicity of derris root is resulting in a constant improvement in the quality of the root exported, a fact that should not be overlooked by investigation in other countries.—Ed. M.A.J.

ERRATUM.

Bleaching of Palm Oil.

In line 22 of the above named article on page 30 of the January 1933 issue of this journal, for "refined" read "required".

Miscellaneous Article.

THE GIANT SNAIL (*ACHATINA FULICA FER.*) IN MALAYA.

A comprehensive account on the Giant snail in Malaya appeared in 1926* and in that article it was stated that "at present, therefore, the snails are of little actual importance" and that "neither the damage done by the Giant snail nor its numbers have, up to the present, justified the cost of any extensive and organised control measures". The position to-day is similar to that of six years ago with the exception that the snail has been reported from other areas, that in 1931 on one estate damage to young rubber and to cover crops was reported and that the writer observed on one occasion slight injury to a few coffee berries. Even in some gardens where the snail is prevalent, the damage to flowering plants and vegetables has not been extensive and the chief objection to the snail in gardens would appear to be more intimately associated with its presence rather than with the injury it inflicts to garden vegetation.

The Giant snail is seen on hibiscus, gardenia and other plants, but that is not evidence that the snail, if damage is seen, is the responsible agent. The writer has observed the snail feeding on dead hibiscus flowers and frequently the presence of dead hibiscus buds are attributed to its depredations, when, in fact, the cause of the trouble is a small caterpillar (*Sylepta derogata*) which feeds within the buds. Damage to the leaves of gardenia has been attributed to the feeding of this snail, when often the green coloured caterpillar of the hawk moth (*Cephonodes hylas* L.) is responsible. This snail sometimes eats the leaves of cannas, but more frequently night flying beetles are the principle offenders.

In the writer's own garden in Kuala Lumpur a very small snail with a conically shaped shell (*Opeas* sp.?) was a considerably greater pest to seedlings of flowering plants and of lettuces than the Giant snail and perhaps some of the injury to young plants in other gardens may be caused, not by the Giant snail, but by this small conically-shelled snail.

The Giant snail may and does feed on vegetables and young flowering plants, but if regular collections are inaugurated and heaps of rubbish are not permitted to accumulate, little trouble will be experienced. The writer has seen lettuces growing in a garden adjoining Ampang Road, Kuala Lumpur, where snails are abundant and the only control measure which is practised is the collection of all snails in the morning and evening when they are moving either to or away from a bamboo hedge separating the garden from waste land.

There are at least in Kuala Lumpur three places with which the writer is acquainted where the snails are numerous, *vis*:—near the Golf Course, the Exhibition Ground of the Malayan Agri-Horticultural Association and the

* South, F. W., *Malayan Agricultural Journal*, Vol. 14, No. 7, July, 1926.

Federated Malay States Railway's Goods Yard. The proximity of the town refuse dumping ground is undoubtedly responsible for the prevalence of the Giant snail on the golf course, the introduction of plants and vegetables for exhibition purposes for their numbers near the Exhibition ground and the continuous transport of plants with the Giant snails and eggs from other infested areas in Malaya, for their abundance near the Railway Goods Yard.

It is not generally realised that enthusiastic gardeners in sending plants from an infested to a non-infested area are largely responsible for the gradual distribution of this snail throughout Malaya. In those areas, where this snail is absent, every precaution should be taken to examine all imported plants with soil, wrappers or similar material, for this snail and its eggs.

The introduction of parasites of the Giant snail was considered by this Department and with this end in view, enquiries were sent to Kenya, Uganda and Tanganyika—the supposed home of the Giant snail. In Kenya, the snail occurs in the coastal regions and for some distance inland but there are no records of damage to plants and no natural check is known. In Uganda it is doubtful if this mollusc occurs and if it does, it is certainly not a pest. In Tanganyika, the meteorological factor, *viz*:—the pronounced dry season, is considered to be the greatest controlling factor. *Achatina* occurs there but solitarily and may be harassed by birds and snakes. It will be seen by the above that very little information was obtained as to the natural enemies in these countries, and, in view of these replies, the contemplated introduction of parasites has not advanced beyond the enquiry stage.

It is not the purport of this note to give a detailed statement as to the habits and control of this insect since an article has already appeared in this Journal. The following is a summary of that paper:—

The eggs which are round and yellow with a hard shell and about the size of a pea are laid in sheltered places, the most favoured being refuse and manure heaps. They may be found in the months of June and July and September and October. The snail is for the most part a scavenger feeding almost exclusively on decaying vegetable and animal matter. It is active during the night and generally hides during the day in sheltered places under hedges, trees and rubbish heaps. Since vegetable accumulations, such as, heaps of grass cuttings, and manure and refuse heaps form ideal breeding and hiding places, the first essential measure for the control of this snail is their complete removal. Cleanliness in and about the garden should be the consideration of all garden owners.

All snails large and small should be collected. This procedure should not be limited to the day time, as, in the evening, snails become active and are more easily seen and readily collected. The snails may be crushed or dropped into boiling water or in a solution of copper sulphate—2 lbs. to 5 gallons of water. The receptacles containing the copper sulphate which can be used repeatedly should not be made of tin or iron.

If the above two recommendations, *viz*:—the disposal of rubbish and the

collections of snails, are regularly practised complaints of the abundance of snails in gardens would not be heard.

Copper sulphate is the chemical specific against snails, and may be used in a variety of ways to protect seedlings or vegetable plants. Shallow ditches filled with sawdust or sifted wood ash which has been immersed in a 10 per cent. solution of copper sulphate will afford temporary protection. Ropes similarly treated may be pegged around vegetable or flower beds. Beds of flowering plants or vegetables may also be protected by enclosing them with $\frac{1}{4}$ inch mesh wire netting about 18 inches high.

Powdered copper sulphate mixed with fine ashes or sawdust and sprinkled around small beds or at about 6 inches from the base of special plants or alternatively a small crystal of ~~technical~~ placed near each plant on the surface of the ground will be found effective.

Copper sulphate solution—1 lb. to 10 gallons of water—may also be sprinkled where the snails are numerous.

If gardeners and others were to cooperate in the removal of all breeding places and in the systematic collection of snails, *Achatina* would be greatly reduced in numbers and would not by any means cause as hitherto so much annoyance.

G. H. C.

CONDITIONS ON SMALL RUBBER HOLDINGS IN MALAYA.

Fourth Quarter, 1932.

*Prepared by the Economics Branch of the Department of Agriculture,
S.S. and F.M.S. in collaboration with the Field Branch of the
Department of Agriculture.*

Rainfall.

In October, the weather in most parts of the Peninsula was wet, with unusually heavy rain and some consequent flooding in Penang, northern Perak and Selangor. Rainfall increased generally throughout the country during November, heavy downpours resulting in floods occurred in Province Wellesley and Penang towards the end of the month. December, on the other hand, was an abnormally dry month, the rainfall returns, with the exception of those from Kuala Selangor and Johore Bahru, were considerably below the average for recent years.

Prices.

Table I included in this article, shows the range of prices among local dealers for small-holders' rubber over numerous centres throughout the country where various factors, such as transport and competition, necessarily affect the prices paid to the producer. The table includes the average monthly Singapore prices for standard sheet and the prices quoted at the end of the month by the large dealers for small-holders' rubber, for the purpose of comparison. All quotations are given in Straits dollars and cents for the price per picul i.e. 133½ lbs.

Tapping.

The exceptionally wet weather experienced in Penang and Province Wellesley, Perak and Selangor during November seriously interfered with the normal tapping operations. It is reported that in south Perak tapping was only possible on from six to nine days during the first half of the month. The work in connection with padi cultivation and harvesting in Krian and parts of Selangor, Malacca, Pahang, Penang and Province Wellesley the Negri Sembilan and Johore was also responsible for a decrease in tapping operations in certain areas of those States. Reports state that in Selangor, Malacca and central Perak tapping was carried out with increasing rigour towards the end of the quarter in order to make up for the enforced periods of comparative idleness.

There has been an increase in areas tapped in Singapore owing to the approach of the Chinese New Year and in Johore after the end of the fruit season in the previous quarter. The practice of tapping the maximum number of trees possible has become general on the majority of holdings in Malacca.

Table 1
Rubber Prices (in dollars per picul i.e. 133½ lbs.)
4th Quarter 1932.

	Singapore Standard sheet Average	Singapore for small holders at end of month	Penang for small holders rubber	Kedah	Province Wellesley	Perak	Selangor	Negri Sembilan	Malacca	Pahang	Johore
Smoked sheet.	9.96	9.30	—	8.50 to 11.50	OCTOBER		7 to 9.25	7 to 10.50	8 to 9.50	8 to 11.50	6 to 10.50
Unsmoked sheet.		8.15	8 to 10	7 to 8.50	8.50 to 11	6 to 11					
Scrap		3	—	3 to 4.50	6 to 9.50	5 to 9	5 to 8	6 to 9	7 to 8	7 to 10.50	5 to 9
Smoked abee	10.33	9.60	—	8.50 to 9.25	1.50 to 4.50	1 to 4.50	1 to 4.50	1.50 to 6	2 to 5	1.75 to 4	1 to 4.85
Unsmoked sheet		8.50	8 to 10	7 to 8.40	NOVEMBER						
Scrap		3.50	4 to 4.50	3 to 4.50	7.50 to 9.90	8 to 10.50	5 to 7.50	6.25 to 9	6 to 9	6.50 to 9.00	5 to 9.20
Smoked sheet.	10.05	9.60	—	8 to 10	2 to 4.20	1 to 3.80	2.50 to 4	1.50 to 6	2 to 5	1 to 4	1 to 4.50
Unsmoked sheet.		8.70	7.50 to 7.70	6.50 to 9	DECEMBER		6 to 9.25	7 to 9.25	8 to 9	6. to 9.20	9 to 9.40
Scrap		4.20	3.50	2.60 to 3.60	6.70 to 10	6.50 to 9	5 to 7.50	5 to 8.00	7 to 8	5 to 8	4.75 to 8
					2 to 4	1 to 4.50	2 to 3.75	1.50 to 4	1.50 to 4	1 to 4	1 to 3.80

Report from the Negri Sembilan states, on the other hand, that among the Chinese-owned holdings there is a noticeable tendency towards selective tapping, the more unproductive trees being left to rest.

Bark Consumption Investigations. The records of consumption and reserves of bark, yields and rates of bark renewal have been completed on 74 out of the total 90 holdings under observation, the resulting figures are now in the course of compilation. Monthly measurements are still being taken on a further 13 holdings, on 11 of which tapping had been suspended for varying periods during the past year. Observations will not be completed on some of these holdings until April next. Four holdings have been put out of tapping until such time as there is a material improvement in the rubber market, so that it will be impossible to obtain 12 monthly records from these areas.

Postponement or acceleration of bringing young rubber into tapping. It is stated that in some parts of the Negri Sembilan there is a tendency to postpone the tapping of young rubber owing to the unremunerative yields of the trees. As mentioned in the report on the preceding quarter, this also applies to the State of Johore.

Areas out of tapping on Small Holdings.

Accurate figures of areas of tappable rubber which are out of tapping on estates of 100 acres and over are received and published monthly, but hitherto, with sole exception of the Negri Sembilan, where the Agricultural Field Officer has obtained monthly figures from the Malay headmen relating to Malay-owned holdings of approximately ten acres and under, no information has been received concerning the tappable areas which are untapped on small holdings.

Attempts were made in one district in Selangor at inaugurating the compilation of similar figures by Malay headmen, but were finally abandoned owing to the length of time taken in their collection and to the very obvious inaccuracy of such results as were obtained.

It was thought that a series of observations among the numerous road-side holdings would indicate, approximately, the proportion of the total number which were untapped, consequently a number of counts were taken of the holdings both tapped and untapped, at various times, along the sides of the main roads in the Negri Sembilan, Selangor, Pahang, Perak and Malacca.

This series of observations was started experimentally in June, 1932, when it was found that figures thus obtained in the Negri Sembilan approximated reasonably closely with those furnished by the Malay headmen, when due allowance was made for the holdings owned by Chinese and Tamils which were not included in their estimates.

This system of counting road-side holdings was begun on a small scale in Malacca, the Negri Sembilan and Selangor over approximately 100 miles of main road. The area was extended in July and August to cover 132 miles of road in the Negri Sembilan, 186 miles in Selangor and 48 miles in Pahang; in

September observations were also made over approximately 225 miles of road in Perak.

Since it was considered that the figures obtained by this method had proved themselves of considerable value in estimating the total area untapped amongst small holdings, in October the Agricultural Field Officers in the Federated Malay States were asked to continue to take observations in their States on the above lines, with the result that during October, November and December figures were obtained from a total of 6,833 holdings in the more important areas of small rubber holdings covering a total distance of 777 miles of road. Further observations were made on 322 holdings over 72 miles of road in Malacca territory during November and December.

In order to compute the acreage of tappable rubber (1926 planting and earlier) which was out of tapping, the figure showing the percentage number of holdings untapped along the road-sides in each District was applied to the known total area of holdings under 100 acres in that District. Table II shows the areas untapped in each District during the month of December, 1932, as calculated from the foregoing system of observation. The figures for the preceding months are too inadequate for the purpose of inclusion in this table.

Prior to the organised observations made by Agricultural Field Officers in October, counts had only been taken by two officers of the Department in the course of their routine travelling. It is of interest to note, however, that from the figures collected in the Federated Malay States, during the period of July to December, 1932, an average of 16 per cent., or 82,000 acres, of the total tappable area of 511,000 acres, are shown to have been untapped.

In the case of the three Districts marked with an asterisk in table II the few holdings situated on the road-sides had not been accepted as being indicative of the majority in these areas, therefore the estimated area only has been included.

Figures for areas out of tapping in Malacca are not included in table II on account of the fact that in the Central District no record is available as to areas of small holdings planted yearly, only the total area at the end of 1931, *viz.* 17,732 acres being known. It is therefore impossible to show the total area of tappable rubber for this District.

In Alor Gajah District during December 2,399 acres or 8 per cent. of the tappable area was out of tapping and in Jassin District 2,738 acres or 11.5 per cent.

The figures throughout the period have shown considerable fluctuations in each locality and in each month. During the period of August-September, when rubber prices reached their highest for the latter half of the year, there was generally a corresponding increase in the area tapped over that of the preceding months, but with this exception, there was no apparent relationship between market prices and areas untapped.

In Districts where there are large areas of padi there was, in some cases, a perceptible increase in the amount of rubber untapped at such times as the

labour was absorbed by work in the padi fields, but this factor was not sufficiently great to show a definite correlation between the fluctuations of the total areas out of tapping and work in connection with padi cultivation in any of the Federated Malay States. This is probably owing to the fact that the more important padi growing districts are not usually large rubber producing districts. It would, therefore, appear impossible to ascribe the variations in untapped areas from month to month to any one particular cause.

Diseases.

Mouldy rot.—Although no newly infected areas have been reported during the quarter, the advent of wet weather during November caused a correlative recrudescence of this disease in all previously infected areas throughout the Peninsula. As before, the impoverished condition of the small-holder has meant that the normal enforcement of the regulation treatment which entails the cessation of tapping during a period when three paintings with an approved disinfectant are carried out is almost impossible of achievement. Indeed, the most that can be done is to encourage as much painting as possible. In consideration of this, the amount of voluntary painting with disinfectants which has been observed in some localities is reasonably gratifying.

Pink disease.—No serious outbreaks of this disease have been observed; sporadic cases are reported from Muar in Johore, Kuala Muda, Baling and Kota Star in Kedah, Ulu Selangor and Kuala Lumpur, Ulu Ijok in Krian and Changhat Jong and Dajang in southern Perak.

Root diseases.—There is no noteworthy observation to be made under this heading for the current quarter.

Budgrafting.

Report from Johore states that a Japanese small-holder in Muar District has budgrafted 150 trees on his holdings during the quarter, furthermore, a few Chinese small holdings in the Segamat District are said to have been budgrafted.

Grades of Rubber Made.

The popularity of the sale of unsmoked sheet among small-holders is still maintained, with the sole exception of the coastal Districts of Selangor where its production, which was never very considerable, has now been discontinued. The figures for the comparative production of the three grades of rubber, where such have been recorded, are as follows:—Perak, (central Districts only) smoked sheet 35 per cent: unsmoked sheet, 45 per cent. and scrap 20 per cent. Malacca, smoked sheet 40 per cent., unsmoked sheet 36 per cent. and scrap 24 per cent.

It should be noted that unsmoked sheet is usually cured by the local dealers who deduct the cost of this from their payments to the producer.

Table II.
Acreage of Tappable Rubber in the F.M.S. which was out of Tapping on Holdings of less than 100 Acres, during December 1932.

PERAK				SELANGOR				NEGRI SEMBILAN				PAHANG			
District	Total tappable area	Total area untapped	Percentage	District	Total tappable area	Total area untapped	Percentage	District	Total tappable area	Total area untapped	Percentage	District	Total tappable area	Total area untapped	Percentage
Batang Padang	36,015	1,369	3.8	Klang	18,449	7,416	40.2	Seremban	18,834	5,217	27.7	Raub	6,583	1,007	15.3
Kinta	33,886	2,202	6.5	Kuala Langat	29,108	3,493	12.0	Tampin	17,391	2,434	14.0	Kuala Lipis	15,147	5,529	36.5
Kuala Kangsar	42,665	4,266	10.0	Ulu Langat	38,425	3,438	9.0	Kuala Pilah	17,253	6,556	38.0	Bentong	13,005	1,561	12.0
Upper Perak	12,378	2,772	22.4	Ulu Selangor	29,272	4,098	14.0	Jekebu	6,248	375	6.3	Other Districts	20,498	6,784†	23.0†
Larut & Selama	50,474	5,451	10.8	Kuala Lumpur	21,062	4,800†	16.0†	Port Dickson	9,995	3,998	40.0				
Krian	9,598	1,248	13.0	Kuala Selangor	8,870										
Lower Perak	46,412	4,641*	10.0*												
	231,428	21,949	9.5		145,186	23,265	16.0		69,721	18,580	26.6		64,233	14,881	23.17
Total area of tappable rubber on small holdings in F.M.S. = 511,000 acres.				Total area of tappable rubber on small holdings in F.M.S. = 511,000 acres.				Total area of tappable rubber on small holdings in F.M.S. = 511,000 acres.				Total area of tappable rubber on small holdings in F.M.S. = 511,000 acres.			
"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"
"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"
"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"

* Estimated from same percentage as shown in Kuala Kangsar District.

† Estimated from average percentage for remainder of State.

It is interesting to note that the Negri Sembilan in December, work was being carried out in the padi fields in both Seremban and Kuala Pilah, two of the Districts which show higher percentages of holdings untapped. In Pahang, padi harvesting was general during the month. The high percentages untapped in the Klang District of Selangor and in the Port Dickson District of the Negri Sembilan have been more or less constant throughout the period of observation probably owing, more particularly in Klang, to the poor growth of the trees and the uneconomic yields obtained.

Slab rubber is sold, in moderate quantities only, in the Larut, Krian and Selama Districts of Perak, where its prices per picul have ranged from \$2.75—\$5 in October, \$2—\$4 in November and \$2.50—\$5 in December.

Tendency to Abandon Rubber Cultivation for Alternatives.

During each month of the period under review reports from Singapore have stated that considerable areas of old rubber are being cut out and other crops, principally fruit trees, are being substituted. Owing to the fact that the majority of small holdings on the island have been untapped for a considerable period, this destruction of rubber will probably have no immediately perceptible effect on the total rubber production from the small holdings in Singapore.

From general observations elsewhere it may be definitely stated that there are no signs of a popular tendency to destroy rubber trees for the planting of other crops. Indeed, in Selangor, where previously some such activities on a small scale had been reported, there has been no further instance of this, as it would appear that sufficient land has now been cleared to enable owners to plant small areas of food crops for their own consumption.

A few isolated instances of the cutting out of a small number of trees has, however, been observed in the Negri Sembilan and the central Districts of Perak.

General Upkeep of Holdings.

On the majority of holdings of a small area, very little attention is paid to general sanitation. On many of the older planted holdings the growth of weeds is kept in some check by the dense shade caused by the close planting of the trees or by sporadic efforts to reduce it on the part of the owner. Many small holdings of more recent planting are very heavily overgrown with weeds bush and "lallang" grass and little attempt is made to do more than to clear narrow avenues in which the tapper may walk from tree to tree.

The complete abandonment of rubber is rare except in cases where, owing to swampy or very barren soil the trees are unproductive.

Among holdings of a larger area, *i.e.* of approximately twenty acres and over, the majority of which are Chinese or Tamil owned, some system of weeding is generally practised.

Departmental.

FROM THE DISTRICTS.

January, 1933.

The Weather.

Generally speaking, January is a moderately wet month in most parts of the Peninsula, although rainfall is normally below that of December. Exceptions are the northwest coast, namely that of Kedah and Province Wellesley and the coast of Malacca and Negri Sembilan where January weather is considerably drier than in the remainder of the country. This year, as a result of the abnormally dry December, January's rainfall is in many cases above that of the previous month, although approximately average for most of the country. Exceptions are the main range running through Perak and the east coast of Pahang where the rainfall was above the average. This also applies to the strip of Perak-Selangor coast from Parit Buntar southward to Klang.

Remarks on Crops.

Rubber.—The local range of prices for kampong rubber shows a still further slight fall as compared with last month's figures, the range per picul being from \$5.30—\$9.30 for smoked sheet, \$3.00—\$8.00 for unsmoked sheet and \$1.00—\$4.50 for scrap. In these figures two abnormal price quotations have been omitted, namely \$4.00 as the lowest price for smoked sheet at Ulu Langat and \$1.50 as the lowest price for unsmoked wet sheet at Batu Kurau in north Perak. The corresponding average prices in Singapore for kampong rubber were \$8.00 for smoked sheet, \$7.00 for unsmoked sheet and \$3.20 for scrap.

As usual, accelerated tapping took place in small holdings in most areas by Chinese and Malays in an endeavour to realise extra cash or credit for the celebration of the Chinese festival of New Year and the Malay festival of Hari Raya.

There is nothing fresh to report in the matter of disease or sanitation of small holdings.

Padi.—The price at the Bagan Serai Government Mill was \$1.62 per picul, a slight drop as compared with the price obtaining during the last few months. This is equivalent to about 6½ cents per gantang.

Harvesting of the crop was general during the month in Kedah, Province Wellesley, the Seremban and Tampin Districts of Negri Sembilan, the central mukims of Malacca and the Muar District of Johore. At the end of the month it was completed in the inland Districts of Selangor, the Jelebu District of Negri Sembilan, the inland mukims of Malacca and throughout west Pahang and the riverine mukims of east Pahang. The crop is reported to be generally good throughout the country. In Krian, harvesting has commenced sporadically

throughout the District. The crop in the eastern portion of the District, comprising the mukims of Bagan Serai, Briah, Selinsing and Gunong Semanggol, will be ready for harvest during next month and prospects are good. As previously reported, throughout the coastal and north parts of the District conditions are irregular and some of the late planted areas will not be ready for harvest until the end of March or beginning of April. Although the plants look very promising at the moment throughout this latter area, prospects cannot be considered as anything but doubtful in view of the anticipated lateness of harvest. A commencement has also been made in Upper Perak and harvesting is expected to be general throughout Kuala Kangsar and Larut Districts next month. It has also begun in the Kuala Pilah District of Negri Sembilan. In the Alor Gajah and Jasin coast mukims of Malacca the crop is somewhat late and is not yet ready for harvest. High winds accompanied by heavy showers have caused lodging of the crop in certain localities in Province Wellesley and Perak.

Further details regarding the increased areas planted in Pahang mentioned last month, indicate that the increase in area is confined to the Districts of Kula Lipis and Temerloh.

Coconuts and Copra.—The price of copra has fallen during the month, Singapore quotation being \$4.85 per picul as compared with \$5.10 for last month, whilst the Penang quotation has ranged between \$4.00—\$4.25 for this month as against \$4.60 throughout last month.

This month's reports contain mention of continued steady progress in the matter of improvement in kiln construction and copra manufacture by small-holders. Thus in Province Wellesley the erection of further improved kilns has been commenced. On the other hand keen competition has forced the temporary suspension of production of copra on some Malay kilns in Penang.

In Selangor, a number of Malays gave up copra manufacture during the fasting month but it is interesting to note that all the improved kilns continued working regularly excepting for a few days before and after Hari Raya. Notwithstanding the drop in the price of copra the price of nuts has remained stationery. Consequently a number of Malays who had been manufacturing copra reverted to the sale of nuts instead. Signs of some progress, however, are not altogether wanting, as group manufacture is still extending in parts of Kuala Selangor District and the copra turned out by such group manufactures has maintained at a high standard. Further progress towards improvement of kilns has been made during the month at Sabak. The practice, reported a few months ago, of the preparation of coconut oil for their own requirements by Malays still continues in Kuala Langat District and 24 gallons were sold at Banting at the last Village Fair of the month.

The price of nuts sold for eating increased temporarily during the month as a result of the demand in connection with the Chinese and Mohammedan Festivals.

Cloves.—It is noted that the price of \$50.00 per picul for this product in Penang is maintained.

Tobacco.—During the month a little over 40 piculs of locally grown tobacco were sold at Penang and Bukit Mertajam, prices ranging between \$10.00—\$40.00 per picul of cured leaf according to quality. In south Perak, cultivation of the crop still receives attention and has replaced tuba on some areas. In the Baling District of Kedah 21 acres were planted during the month.

Arecanuts.—A few months ago the Krian report contained details regarding trial consignments of graded arecanuts sent by the Telok Medan Co-operative Society to the Penang market. The transaction resulted in an enhanced price for growers. It is reported that three further consignments were sent to Penang and some improvement in grading had been attained. Similar attempts at co-operative grading and sale are being made at Padang Rengas in Kuala Kangsar District, but further improvement is needed in the matter of preparing the product and grading it. Similar activities are reported as taking place in the Kundang and Batu Laut mukims of Kuala Langat, Selangor.

Agricultural Stations and Padi Test Plots.

Agricultural Stations.—Steady progress continued throughout the month at Bukit Mertajam Station and the whole of the low-lying area was sub-soil drained with 4 inch pipes. Further progress was made in stocking the Station at Temerloh, a number of fruit trees, arecanuts and bananas being planted during the month. At Tanah Rata, Cameron Highlands, improvements to the Tea Factory were completed.

Padi Stations and Test Plots.—Harvesting is in progress or about to commence at all Padi Stations and Test Plots in Kedah and Perak. At the Titi Serong Experiment Station some trouble was experienced in water control as the result of heavy rain on the 19th and the deep water caused the padi to lodge in places. Reaping is nearly completed at Rembau Test Plot in the Negri Sembilan and good progress with harvesting has been made throughout the month at Pulau Gadong Experiment Station in Malacca. At the Test Plots at Tangkak, Sungei Mati and Sungei Balang in Johore, harvesting was completed and the Pulau Gadong pedigree strains S.M. 29 and N. 66 gave very satisfactory yields.

DEPARTMENTAL NOTES.

Visits of the Director of Agriculture.

Dr. H. A. Tempany, C.B.E., in company with the Chief Field Officer and the Agriculturist, visited Cameron Highlands from January 17th to 20th with the object of inspecting the work at the Agricultural Experiment Station. A visit was paid to Kea Farm, the property of Mr. Drewitt, and discussions were held with leading residents of the Cameron Highlands on the work of the Department and on local agricultural policies as a whole.

On the 10th of January the Director of Agriculture visited Singapore to attend a meeting of the Executive Council for the purpose of discussing a bill relating to pineapple legislation.

On the 29th and 30th the Director of Agriculture visited Fraser's Hill and inspected the work at the Government Dairy Farm.

Film on the School of Agriculture, Malaya.

A film which was made by the Department of Agriculture to illustrate work at the School of Agriculture at Serdang, was shown at a meeting of the Advisory Committee of the School and later to the Chief Secretary to Government, the Hon'ble the British Resident of Selangor and the heads of Branches of the Department. Arrangements are being made for the display of this film in certain English schools in Selangor and it is intended that subsequently, this film should form a part of the cinematographic exhibits of the Rural Lecture Caravan.

Advisory Committee for the School of Agriculture.

A meeting of the Advisory Committee for the School of Agriculture, Malaya, was held on January 5th, among the other subjects on the agenda was the question of the institution of a scholarship scheme for the school.

Marketing of Peasant Produce.

Arrangements have been made for the establishment of a liaison committee between the Agricultural and Co-operative Departments and the Rubber Research Institute of Malaya, with the primary object of considering, and discussing problems in connection with the marketing of peasant produce. The Committee is an expansion of the Film Propaganda Committee and its formation is the direct outcome of proposals made at the Agricultural Conference held in Kuala Lumpur in August last.

Government Dairy Farm, Fraser's Hill.

A considerable amount of useful information has become available as a result of the past year's working of the Government Dairy, Poultry Farm and Gardens, at Fraser's Hill, Pahang. It is felt that the experience gained will

be of assistance to those who are either already undertaking or contemplating farming operations at high elevations in Malaya. An article reviewing the results to date of this undertaking of the Department is in course of preparation.

There has been a steady demand for fresh cream from visitors to the hill.

During the dry weather excellent results have been obtained with vegetable production, there being a sufficient supply for the requirements of the hill and a surplus which forms a ready sale in Kuala Lumpur.

New Title.

The title of the appointment of Assistant Agriculturist, Cameron Highlands of the Agricultural Department, S.S. & F.M.S. has been altered to Agricultural Field Officer, Cameron Highlands with effect from 1st January, 1933.

Leave.

Mr. J. L. Greig, Assistant Agriculturist, has been granted 8 months and 16 days leave on full pay with effect from 26th January 1933.

Dr. H. W. Jack, M.B.E., Economic Botanist, returned from leave of absence on 2nd February 1933.

Statistical. MARKET PRICES.

January, 1933.

The Singapore Chamber of Commerce Market Report dated 28th January 1933 points out that the Produce markets were closed for the last three days of the week for Chinese and Malay holidays. Prior to these neither buyers nor sellers shewed any keenness to operate and very little business has been recorded in the following products:—copra, cloves, gums, mace, nutmegs, pepper, pineapples, sago flour.

Rubber.—The highest price recorded in Singapore during January for rubber smoked sheet, equal to London Standard was 7 1/16 cents per lb. on 7th. and the lowest price 6 5/16 cents on 31st. The average price for the month was 6.75 cents per lb. in Singapore, 2.28d. London and 3.01 cents gold New York; as compared with 7.54 cents, 2.48d., and 3.20 cents gold respectively in December 1932.

Palm Oil.—The course of the market during the month of January was as follows:—4th. £17 - 10; 11th. £17; 18th. £16 - 10; 26th. £16 - 10 on a basis of 18 per cent. f.f.a., c.i.f. Liverpool. During the first half of the month the market was reported quiet, while during the second half of the month the market was nominal.

Copra.—The decline in prices, noted in last month's report continued throughout January, the price of sundried at the beginning of the month being \$5.45 per picul and falling to \$4.75 by the end of the month. The average price of this grade in January was \$5.16 per picul as compared with \$5.72 in December, while the mixed quality which averaged \$5.20 per picul in December, averaged \$4.72 in January.

Copra cake was quoted throughout the month at \$2.10 per picul.

Coffee.—The Singapore price of Sourabaya coffee fell by about \$1.50 per picul during the month. The average price in January was \$25.37 to \$27.50 the price within this range depending upon quality. Palembang coffee dropped by 50 cents to \$19.50, the average price in January being \$19.75 per picul.

Arecanuts.—Palembangs remained steady at \$2.75 per picul and Bila Whole averaged \$2.69 as compared with \$2.65 and \$3 per picul respectively in December. Singapore average prices for other grades were:—Split \$3.12 to \$5.14, Red Whole \$4 to \$5, Sliced \$5.75 to \$7.49 per picul, the price within each range depending upon quality.

Rice.—The following are the average wholesale prices per picul of rice in Singapore during December: Siam No. 2 \$3.65; Rangoon No. 1 \$3.20 as compared with \$3.79 and \$3.41 respectively in November.

The average wholesale prices throughout the year 1932 were:—Siam No. 2 \$3.97; Rangoon No. 1 \$3.73, as compared with \$4.05 and \$3.74 (July - December only) for 1931.

The average retail market prices in cents per gantang of No. 2 Siam rice

in December were :—Singapore 28, Penang 30, Malacca 27, as compared with 30, 30 and 27 respectively in November.

The average retail prices throughout the year 1932, for No. 2 Siam rice were :—Singapore 30, Penang 34, Malacca 28, as compared with 32, 35 and 31 respectively for 1931.

Gambier.—Block gambier has remained steady throughout the month at \$5 per picul, while Cube No. 1, which for the first three weeks of January stood at \$9 per picul thereafter fell to \$8, the average price for the month being \$8.75 per picul. Average prices in December were Block \$5.20, Cube No. 1 \$9.80.

Pineapples.—Prices have remained practically unchanged throughout the month with a slight downward tendency at its close. Average Singapore prices per case in January were :—Cubes \$3.20, Sliced flat, \$2.97, Sliced tall \$3.34 as compared with \$3.07, \$2.85 and \$3.26 respectively in December.

Tapioca.—Flake appreciated by 40 cents per picul to \$4.30 during the second half of the month, the average price per picul in January being \$4.10 as compared with \$3.70 in December. Pearl seed was quoted throughout January at \$4.60 and Pearl medium at \$4.75; average price per picul for these grades in December were \$4.12 and \$4.22 respectively.

Sago.—Pearl small fair was quoted at \$3.90 throughout January, as compared with an average price of \$3.98 in December. Flour, Sarawak, fair averaged \$2.01 per picul in January as compared with \$2.15 per picul in December.

Mace.—Prices more or less nominal, and quoted throughout the month at \$62 per picul for Siouw and \$40 per picul for Amboina. Similar prices ruled during the previous month.

Nutmegs.—Singapore prices were quoted throughout January at \$25 per picul for 110's and \$26.50 per picul for 80's. Corresponding prices in December were \$25.20 and \$30.60 per picul respectively.

Pepper.—Prices have further declined throughout the month. Singapore Black averaged \$16.62 per picul, Singapore White \$20.31 per picul and Muntok White \$20.69 per picul as compared with \$17.25, \$21.65 and \$22.15 respectively in December.

Cloves.—Market continues featureless, nominal prices being quoted at \$40 per picul of Zanzibar and \$45 per picul for Amboina.

The above prices are based on London and Singapore daily quotations for rubber; on the Singapore Chamber of Commerce Weekly Reports for the month and on other local sources of information. Palm Oil reports are kindly supplied by Messrs. Cumberbatch & Co., Ltd., Kuala Lumpur, the Singapore prices for coffee and arecanuts by the Lianqui Trading Company of Singapore.

1 picul = 133½ lbs. The Dollar is fixed at two shillings and four pence.

Note.—The Department of Agriculture will be pleased to assist planters in finding a market for agriculture products. Similar assistance is also offered by the Malayan Information Agency, 57, Charing Cross, London, S.W. 1.

GENERAL RICE SUMMARY.*

December, 1932.

Malaya.—Gross foreign imports of rice (including stocks available for re-export) during December, 1932, amounted to 57,402 tons, as compared with 53,377 tons in December, 1931, of which 55 per cent. were consigned to Singapore, 19 per cent. to Penang, 8 per cent. to Malacca, 16 per cent. to the Federated Malay States and 2 per cent. to the Unfederated Malay States.

Of these imports, 62 per cent. were from Siam, 35 per cent. from Burma, 4 per cent. from Indo-China and 1 per cent. from other countries.

Total foreign exports of rice from Malaya in December, 1932, were 17,876 tons (including 131 tons local production) as compared with 17,515 tons in 1931.

Of these exports 85 per cent. were consigned to Netherlands India and 15 per cent. to other countries.

Net imports for the period January to December 1932 were 409,631 tons as compared with 516,832 tons during the same period for 1931, a fall of 20 per cent.

India and Burma.—Total foreign exports of rice during November, 1932, were 100,000 tons as compared with 72,000 tons in October, 1932, and 135,000 tons in November, 1931, an increase of 39 per cent. in respect of the previous month and a decrease of 26 per cent. in respect of the same period in the previous year.

Total exports during the period January to November, 1932, were 1,966,000 tons as compared with 1,941,000 tons for the corresponding period of 1931, an increase of 1 per cent.

Total exports of rice and bran from Burma during the period January 1st to November 30th, 1932, amounted to 3,993,090 tons, as compared with 4,914,044 tons for the corresponding period of 1931, a decrease of 19 per cent. Of these exports 917,314 tons went to India in 1932 as compared with 1,374,356 tons in 1931, a decrease of 33 per cent.

Japan.—No information received.

Formosa.—No information received.

Siam.—Exports (approximate) during December, 1932, amounted to 130,000 tons as compared with 114,000 tons in December, 1931, an increase of 14 per cent.

At the end of December, 1932, the area under padi in 60 Provinces amounted to 7,475,000 acres, an increase of 261,000 acres or 4 per cent. as compared with the same period of 1931. The area harvested to date was 943,000 acres yielding 509,000 tons, an increase in area of 53,000 acres or 6 per cent. and 67,270 tons or 15 per cent. over the yield figures for the corresponding period of 1931. The area damaged is estimated at 301,000 acres, a decrease of 429,000 acres or 59 per cent. from that of the previous year.

* Abridged from the Rice Summary for December, 1932, compiled by the Department of Statistics, S.S. and F.M.S.

Netherlands India, Java and Madura.—For the period January to November, 1932, the area harvested amounted to 8,884,000 acres an increase of 420,000 acres or 5 per cent. as compared with the corresponding period of 1931: the area damaged was 354,000 acres a decrease of 116,000 acres or 25 per cent. as compared with 1931, and additional plantings awaiting harvesting amounted to 1,794,000 acres a decrease of 59,000 acres or 3 per cent. The total acreage at the end of November, 1932, amounted to 11,032,000 acres, an increase of 245,000 acres or 2 per cent. as compared with the same period in 1931.

Imports of rice into Java and Madura during January to November, 1932, totalled 136,537 tons, a decrease of 127,096 tons or 48 per cent. as compared with the same period of 1931.

Imports of rice into the Outer Provinces during January to October, 1932, amounted to 219,689 tons, a decrease of 49,439 tons or 18 per cent. as compared with the same period of 1931.

French Indo-China.—Entries of padi at the port of Cholon from January 1st to December 31st, 1932, amounted to 1,113,000 (metric) tons, an increase of 15,000 tons or 1 per cent. as compared with the same period of 1931.

Exports of rice from Saigon for the period January to December, 1932, totalled 1,192,000 tons, an increase of 230,000 tons or 24 per cent. as compared with the corresponding period of 1931.

Ceylon.—Imports for the period January to November, 1932, totalled 399,467 tons, a decrease of 71 tons on the imports for the same period of 1931.

Of these imports 20 per cent. were from British India, 70 per cent. from Burma, 4 per cent. from the Straits Settlements and 9 per cent. from other countries.

Europe and America.—Quantities of rice shipped from the East were:—

- (a) To Europe for the period January 1st to December 21st 1932, 1,010,000 tons, a fall of 31,000 tons or 3 per cent. as compared with the same period of 1931. Of these 1932 shipments 52 per cent. were from Burma, 2 per cent. from Japan, 38 per cent. from Saigon, 5 per cent. from Siam and 3 per cent. from Bengal, as compared with 57 per cent. from Burma, 7 per cent. from Japan, 28 per cent. from Saigon, 6 per cent. from Siam and 2 per cent. from Bengal in 1931.
 - (b) To the Levant, period January 1st to November 25th, 1932, 48,060 tons, a fall of 16,810 tons or 26 per cent. as compared with the same period of 1931.
 - (c) To America and the West Indies for the period January 1st to November 9th, 1932, 118,366 tons, a decrease of 27,633 tons or 19 per cent. as compared with the same period of 1931.
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ACREAGE OF TAPPABLE RUBBER OUT OF TAPPING ON ESTATES OF 100 ACRES AND OVER, MALAYA, AT THE END OF DECEMBER, 1932.

STATE OR TERRITORY	ACREAGE OF TAPPABLE RUBBER end 1931	ESTATES WHICH HAVE ENTIRELY CEASED TAPPING		ESTATES WHICH HAVE PARTLY CEASED TAPPING		Total (3) + (5)	Percentage of (7) to (2)
		Acreege (3)	Percentage of (3) to (2) (4)	Acreege (5)	Percentage of (5) to (2) (6)		
FEDERATED MALAY STATES :—							
Perak	238,420	13,441	5.6	30,669	12.9	44,110	18.5
Selangor	294,030	17,981	6.1	36,632	12.5	54,613	18.6
Negri Sembilan	217,002	17,946	8.3	20,110	9.3	38,056	17.5
Pahang	35,122	8,309	23.7	4,278	12.2	12,587	35.8
Total F.M.S.	784,574	57,677	7.4	91,689	11.7	149,366	19.0
STRAITS SETTLEMENTS :—							
Province Wellesley	44,055	2,019	4.6	8,726	19.8	10,745	24.4
Dindings	6,700	310	4.6	1,005	15.0	1,315	19.6
Malacca	110,288	5,451	4.9	21,360	19.4	26,811	24.3
Penang Island	1,585	1,058	66.8	59	3.7	1,117	70.5
Singapore Island	28,033	12,752	45.5	4,068	14.5	16,820	60.0
Total S.S.	190,661	21,590	11.3	35,218	18.5	56,808	29.8
UNFEDERATED MALAY STATES :—							
Johore	313,385	41,266	13.2	35,426	11.3	76,692	24.5
Kedah (a)	114,254	11,114	9.7	7,112	6.2	18,226	16.0
Kelantan	16,785	9,695	57.8	1,350	8.0	11,045	65.8
Trengganu (b)	4,300	Nil	Nil	2,120	49.3	2,120	49.3
Perlis (c)	903	106	11.7	462	51.2	568	62.9
Total U.M.S.	449,627	62,181	13.8	46,470	10.3	108,651	24.2
TOTAL MALAYA	1,424,862	141,448	9.9	173,377	12.2	314,825	22.1

Notes :— (a) Registered companies only and are rendered quarterly, commencing with June 1931.
 (b) Registered Companies only.
 (c) The above figures quoted for Kedah and Perlis are those for September, revised figures will be published when available.
 The above table together with a Summary was prepared and published by the Statistics Department, S.S. and F.M.S. in January 1933.

**ACREAGE OF TAPPABLE RUBBER OUT OF TAPPING IN
NETHERLANDS INDIA AT END OF NOVEMBER, 1932.**

	A Totally Ceased		B Partly Ceased		Total A & B	
	Estates	Area in Acres	Estates	Area in Acres	Estates	Area in Acres
Java and Madura ...	167	87,932	58	14,355	225	102,287
Outer Provinces ...	201	84,555	66	32,797	267	117,352
Netherlands India ...	368	172,487	124	47,152	492	219,639

MALAYAN AGRICULTURAL EXPORTS, DECEMBER, 1932.

PRODUCT.	NET EXPORT IN TONS.			
	Dec. 1931	Dec. 1932	Year 1931	Year 1932
Arecanuts ...	1,740	1,731	19,266	20,280
Coconuts fresh ...	1,900	829†	10,468	7,723†
Coconut oil ...	874	1,281	9,909	11,932
Copra ...	9,810	6,768	100,809	97,464
Gambier, all kinds ...	164	172	2,563	1,925
Palm kernels ...	82	150	726	1,248
Palm oil ...	649	592	4,574	7,892
Pineapples Canned ...	7,170	6,231	59,457	66,291
Rubber § ...	39,837	40,974	434,857	417,137
Sago—flour ...	1,527	974	5,608	10,267
" —pearl ...	216	176	2,429	3,228
" raw ...	140*	315*	2,904*	4,148*
Tapioca—flake ...	813	682	9,742	9,028
" —flour ...	119*	284	491*	392
" —pearl ...	1,876	1,409	19,006	19,977
Tuba root ...	6	39†	74	165†

‡1,161,000 in number. †10,812,300 in number. * net imports. § Production.

TABLE I
MALAYA RUBBER STATISTICS
STOCKS, PRODUCTION, IMPORTS AND EXPORTS OF RUBBER, INCLUDING LATEX, CONCENTRATED LATEX AND REVERTED,
FOR THE MONTH OF DECEMBER, 1932 IN DRY TONS.

Territory	Stocks at beginning of month 1			Production by Estates of 100 acres and over			Production by Estates of less than 100 acres estimated 2			Imports			Exports including re-exports			Stocks at end of month		
	Ports	Dealers	Estates of 100 acres and over	during the month	during the year 1932	during the month	during the year 1932	during the month		during the year 1932		during the month		during the year 1932		Ports	Dealers	Estates of 100 acres and over
								Foreign	From Malay States	Foreign	From Malay States	Foreign	Local	Foreign	Local			
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
MALAY STATES:—																		
Federated Malay States																		
...	...	13,927	1,196	12,947	140,535	10,082	93,371	Nil	Nil	Nil	Nil	12,938	7,964	163,669	72,223	...	14,718	13,273
...	...	2,751	3,084	4,046	44,043	4,137	42,712	Nil	5	Nil	74	980	7,041	11,767	74,919	...	2,640	3,562
...	...	825	1,995	2,770	27,567	1,327	12,245	Nil	Nil	Nil	Nil	665	3,077	7,938	31,106	...	835	2,540
...	...	34	13	82	23	23	95	Nil	Nil	Nil	Nil	Nil	26	Nil	159	...	37	15
...	...	250	164	101	1,695	254	3,123	Nil	422	Nil	48	440	586	1,581	160	...	160	121
...	...	55	50	75	1,210	38	607	Nil	Nil	Nil	Nil	Nil	113	Nil	1,817	...	55	50
...	...	17,842	17,264	19,947	215,122	16,061	152,153	Nil	5	422	74	14,631	18,661	183,660	184,869	...	18,445	19,361
Total Malay States																		
SETTLEMENTS																		
...	...	4,939	1,315	1,620	16,472	...	...	3	Nil	3	Nil	3,287	...	48,228	...	...	5,607	1,512
...	...	192	652	585	5,620	...	...	Nil	18,695	Nil	185,031	4,998	Nil	61,766	...	...	146	593
...	...	67	68	106	1,106	2,473	24,877	683	5,114	67,173	185,031	17,202	...	184,296	...	...	32	86
...	...	4,492	13	4	34	...	...	7,110	...	...	...	25,487	...	294,262	...	...	5,046	10
...	...	1,160	20,314	207	178	1,853	24,877	7,736	18,695	72,590	185,031	...	...	...	...	...	3,637	19,823
...	...	3,524	29,404	2,257	2,493	24,985	24,877	7,736	18,695	72,590	185,031	25,487	Nil	...	...	...	6,058	30,744
...	...	4,674	29,404	2,257	2,493	24,985	24,877	7,736	18,695	72,590	185,031	25,487	Nil	...	...	...	6,058	30,744
...	...	4,674	47,246	19,521	22,440	240,107	18,534	177,030	7,796	19,700	72,712	165,105	40,118	18,661	474,232	184,869	6,058	49,189
...	...	4,674	47,246	19,521	22,440	240,107	18,534	177,030	7,796	19,700	72,712	165,105	40,118	18,661	474,232	184,869	6,058	49,189
TOTAL MALAYA																		

TABLE II
DEALERS' STOCKS IN DRY TONS

Class of Rubber	Federation Malay States		S'pore		Penang		Pro-Ince Malay Districts		Johore		Total	
	21	22	23	24	25	26	27	28	29	30	31	32
20	11,517	18,096	4,587	5,680	1,007	40,937	...	...	...	...	...	...
DRY RUBBER	3,201	1,727	509	195	1,683	7,265	...	...	...	...	...	...
WET RUBBER	14,718	19,823	5,046	5,875	2,640	48,102	...	...	...	...	...	...
TOTAL	...	...	...	...	...	...	...	...	...	...	...	...

TABLE III
FOREIGN EXPORTS

Ports	For month		For year	
	1932	1931	1932	1931
Singapore	25,242	28,857	...	...
Penang	8,429	107,867	...	...
Port Swettenham	5,609	61,473	...	...
Malacca	938	10,055	...	...
MALAYA	...	40,118	478,252	...

TABLE IV
DOMESTIC EXPORTS

Area	For month		For year	
	1932	1931	1932	1931
Malay States	...	32,368	405,209	...
Straits Settlements
MALAYA	...	32,368	405,209	...

- Notes.*—1. Stocks on estates of less than 100 acres and stocks in transit on rail, road or local steamer are not ascertained.
2. The production of estates of less than 100 acres is estimated from the formula: Production + Imports + Stocks at beginning of month = Exports + Stocks at end of month + Consumption. i.e. Column [7] = Column [18] + [14] + [17] + [18] + [19] + [2] - [13] - [4] - [5] - [9] - [10]. For the Straits Settlements, Columns [1] and [8] represent purchases by dealers from local estates of less than 100 acres, reduced by 15% to terms of dry rubber.
3. Dealers' stocks in the Federated Malay States are reduced to dry weights by the following fixed ratios: unsmoked sheet, 15%; wet sheet, 25%; scrap, lump, etc., 40%; stocks elsewhere are in dry weights as reported by the dealers themselves.
4. Domestic exports are estimated by deducting the average monthly dry weight of foreign imports over a period of 2 months from the gross foreign exports of the later month, the foreign exports of the Malay States being domestic production.
5. The above, with certain omissions, is the Report published by the Registrar-General of Statistics, S.S. and F.M.S., at Singapore on 21st of January.

METEOROLOGICAL SUMMARY, MALAYA, DECEMBER, 1932.

Locality	AIR TEMPERATURE IN DEGREES FAHRENHEIT										EARTH TEMPERATURE		RAINFALL						BRIGHT SUNSHINE	
	Means of			Absolute Extremes				FAHRENHEIT		PERCENT		Total		Number of days		Total	Daily Mean	Per cent		
	A.	B.	Mean of day and night	Highest	Lowest	Max.	Min.	At 1 foot	At 4 feet	Precipitation 0.01 in or more	Thunder-storm	Fog morning obs.	Gale force 8 or more							
°F	°F	°F	°F	°F	°F	°F	°F	°F	°F	in.	mm.	in.	mm.	in.	mm.	hr.	°			
Railway Hill, Kuala Lumpur, Selangor	89.8	71.8	80.8	93	69	82	74	82.9	83.7	10.57	268.5	2.32	20	16	3	3	196.25	6.33	53	
Bukit Jeram, Selangor	87.3	72.5	79.9	89	70	81	75	83.0	84.9	10.43	264.9	2.54	17	16	5		219.35	7.08	60	
Sitiawan, Perak	89.0	72.0	80.5	92	70	87	75	83.1	83.8	5.59	142.0	1.95	11	9	3	2	230.05	7.42	62	
Kroh, Perak	84.5	68.5	76.5	91	65	79	71	75.9	80.7	1.00	25.4	0.39	9	7			185.20	5.97	51	
Tenerlob, Pahang	86.6	71.7	79.1	92	67	80	74	83.3	84.6	1.74	44.2	0.53	10	9	2		191.05	6.16	52	
Kuala Lipis, Pahang	85.6	70.6	78.1	89	69	78	73	81.9	83.1	3.99	101.4	0.67	20	15	1	17	143.85	4.64	39	
Kuala Pahang, Pahang	83.8	73.9	78.8	87	71	77	79	82.7	84.1	6.62	168.2	1.78	18	12	1		182.05	5.87	49	
Mount Faber, Singapore	86.7	72.8	79.7	90	71	80	75	80.7	82.3	2.46	62.5	0.83	15	11	1		178.70	5.76	48	
Butterworth, Province Wellesley	87.0	72.5	79.7	90	70	84	76	83.1	84.0	1.49	37.9	0.52	6	4	1		238.85	7.70	65	
Bukit China, Malacca	85.1	73.2	79.1	88	72	77	75	81.3	82.6	1.53	38.9	0.38	12	7			202.65	6.54	54	
Kluang, Johore	85.9	71.1	78.5	91	68	78	73	80.4	81.7	4.61	117.1	1.20	15	10	6		164.40	5.30	44	
Bukit Lahang, Mersing, Johore	82.5	72.6	77.5	89	70	74	76	79.1	80.2	13.77	349.8	2.55	24	22			167.80	5.41	45	
Alor Star, Kedah	87.0	71.3	79.1	91	66	83	74	82.9	84.4	1.05	26.7	0.54	6	5	2		206.05	6.65	56	
Kota Bharu, Kelantan	83.3	72.4	77.9	88	69	76	77	81.4	83.0	15.76	400.3	3.42	20	16	1		140.60	4.54	38	
Kuala Trengganu, Trengganu	82.6	71.9	77.3	86	69	76	76	79.2	81.1	18.39	467.1	6.38	25	20			141.75	4.57	39	
HILL STATIONS.																				
Fraser's Hill, Pahang 4268 ft.	70.6	57.5	64.1	75	54	67	60			4.85	123.2	0.89	20	14	1		141.60	4.57	38	
Pahang Highlands, Tanah																				
Cameron Raza, Pahang 4750 ft.	71.3	56.4	63.9	75	46	68	61	68.3	68.8	4.02	102.1	0.75	19	14	2	9	134.05	4.32	36	
Cameron Highlands, Rhododendron Hill, Pahang 5120 ft.	70.0	60.1	65.1	77	57	64	63	70.3	70.9	9.14	232.2	1.61	20	18	19		129.80	4.19	35	

Compiled from Returns supplied by the Meteorological Branch, Malaya.

THE Malayan Agricultural Journal.

MARCH, 1933.

EDITORIAL

Press and Centrifugal Palm Oil Extraction. Ever since the erection of the first oil palm factory in Malaya in 1925 there has been considerable diversity of opinion regarding the relative merits of presses and centrifugal extractors for the original treatment of oil palm fruit.

The treatment of any oil bearing material for the recovery of oil by expression is a method which is used universally and has been so from time immemorial, whereas the centrifugal extraction system is a modern development and its application is limited to soft and pulpy material which is easily mashed. The pericarp of the oil palm fruit fulfils these conditions.

In Sumatra the press system has been employed exclusively, while in Malaya out of a total of 16 oil palm factories, 14 have installed centrifugal and 2 press machinery.

In a previous number of this Journal* it was shown that arrangements had been made for the installation of both types of machinery at the Government Experimental Plantation, Serdang.

The results of experiments with the centrifugal system have already been published in the Journal,† the figures showing, in this particular instance, that between 88 and 89 per cent. of the oil content of the fruit could be recovered.

In the article included in the present number, entitled "A Comparison of the Press and Centrifugal Methods for Treatment of Oil Palm Fruit" by Major C. D. V. Georgi, the author describes a similar series of experiments with the press system as a result of which the possibilities of the two methods under the same conditions are compared.

These experiments have proved that while slightly more oil is recovered from the fruit by expression as compared with centrifugal extraction, the losses on purification of the crude oil are greater for the press than for the centrifugal system, since the latter produces what may be described as a clean crude oil.

In this connection it should be noted that many of the results obtained at Serdang confirm previous figures obtained from analyses of average samples from large factories.

* *Malayan Agricultural Journal*, Vol. XIX, No. 8, August, 1931.

† *Malayan Agricultural Journal*, Vol. XX, No. 9, September, 1932.

The general conclusion is that when commencing the process with clean fruit, as is the practice at Serdang, the final percentage of oil recovery from the fruit is almost identical in both methods.

From the point of view of upkeep, the experimental factory at Serdang has shown that the centrifugal plant has the advantage over the press in that the cost has been lighter in this respect, the centrifugal extractor having required less frequent adjustments.

Concerning the reliability of the centrifugal machinery, it is noteworthy that some plants which were installed in Malaya more than six years ago are still working efficiently.

It has also been proved at Serdang that the centrifugal plant requires 33 per cent. less tank space than the press, owing to the fact that the crude oil does not require to be diluted with water before steaming.

The centrifugal system has the disadvantage that the extractor works intermittently. Since experiments have shown high excess steam pressures in the digester to be unnecessary it should be possible to modify the design of this vessel so as to permit of a system of continuous digestion, thereby increasing the output of the centrifugal extractor.

This series of investigations emphasises the importance, especially for large factories, of the introduction of a regular system of factory control, similar to that adopted with such success in sugar factories, for the analysing of all waste products, so that losses of oil may be reduced to a minimum and the maximum recovery of the product ensured.

Malayan Rice Production in 1932 His Excellency The Governor, Sir Cecil Clementi, initiated a campaign having for its object the encouragement of rice production. His first pronouncement on this subject is contained in his "Message to the *Malayan Agricultural Journal*" of May 1930, shortly after his arrival in Malaya. In this Message he referred to the dependence of Malaya on imported rice and stated that

".....the time has now come when more attention should be paid to rice cultivation as well as to pastoral industries, in order that the staple food of the people may be made available locally."

The policy of His Excellency received the support of Their Highnesses the Rulers, who have continually urged upon their subjects the importance of rice production. The Administrative Service has assisted materially in a similar direction.

The Rice Production Committee examined the subject exhaustively and from every angle, and the favourable result of the past padi season is in great measure due to the prompt translating into action of the findings of this Committee, in particular to the inauguration of the Department of Irrigation and Drainage.

The campaign has been furthered by the insistent efforts of the Department of Agriculture who have carried on continual propaganda through cinema films, lectures and demonstrations during the tours of the lecture caravan, and have inaugurated padi test plots throughout the country.

For many years the policy has been pursued of introducing high-yielding strains of padi, and of minimising the great damage occasioned by rats and other pests by organised work of destruction in all important padi districts.

The success of the padi season 1931 - 32, though in no small measure due to the favourable weather and to the low price of rubber, is also the result of the concerted action of the various Government departments, both administrative and technical, that have been able to give mutual assistance at many points by reason of the fact that they were actuated by the same motives and had the same object in sight.

In consideration of the foregoing it is very gratifying to note that in the season 1931-32, throughout the Peninsula a total of 724,980 acres were planted with this crop which produced a yield of approximately 291,000 tons of rice, an increase over 1931 of 17,240 acres, or 2.4 per cent. in area and 31,899 tons or 12.6 per cent. in yield.

In respect of both the acreage planted and the crop harvested, the figures for the above season constitute a record for Malaya. The reason for the apparent discrepancy between the percentage increase in area and yield is accounted for by the fact that the area under "dry" padi, which is generally only a temporary form of cultivation, has declined by 15,000 acres in favour of an increase in the more permanent system of cultivation of "wet" rice by 32,000 acres.

For the previous 14 years annual production has averaged 50 per cent. of the annual net imports, while production has amounted to an average of 32 per cent. of local consumption. In 1932 Malayan production amounted to 73 per cent. of the net imports and to 42 per cent. of the consumption, an increase of 23 and 10 per cent. respectively.

Rice imports in Malaya for 1932 were 409,630 tons valued at over 27 million dollars (Straits currency) as compared with 515,724 tons, valued at 35 million dollars for 1931. In this connection it must be borne in mind that the large number of alien labourers repatriated and the considerable reduction of the purchasing power of the community are factors which have had an appreciable effect on the decline of rice imports and consumption.

Original Articles.

A COMPARISON OF THE PRESS AND CENTRIFUGAL METHODS FOR TREATMENT OF OIL PALM FRUIT

BY

C. D. V. GEORGI,

Acting Agricultural Chemist.

Introductory.

The present article summarises the results of the remainder of the experiments carried out regarding the factory treatment of oil palm fruit at the Government Experimental Plantation, Serdang, to which reference was made originally in a previous number of this Journal.*

The scheme of work outlined in that article included a study of both the centrifugal and press methods for treating the fruit in order to compare their relative efficiencies. As regards the centrifugal method a full description of the various experiments, including a statement as to the efficiency of the process, was published in a recent number of this Journal.†

In the present article, therefore, it is proposed to consider the press method on similar lines to those adopted for the centrifugal system, the individual experiments for each particular stage of the process being first described, followed by the figures for the efficiency tests. As a result certain observations regarding the comparative efficiencies of the two systems will then be offered.

As explained previously, the object of a preliminary study of the separate stages is to ascertain the particular optimum conditions so as to secure the maximum efficiency for the whole process. From the point of view of the complete process it will be realised that there are certain stages common to the two systems; in such cases therefore only brief references will be made, since full details have been given when dealing with the centrifugal process.

Attention is also drawn to the fact that there are two types of press in general use, the Stork press supplied by Messrs. Gebr. Stork & Co., Amsterdam, Holland and the Krupp press manufactured by Messrs. Fr. Krupp & Co., Grusonwerk, Germany. The present series of experiments was carried out with the Stork press, so that the results of the efficiency tests can be taken as applying only to that type.

* *Malayan Agricultural Journal*, Vol. XIX, No. 8, August 1931.

† *Malayan Agricultural Journal*, Vol. XX, No. 9, September 1932.

Sterilisation of Fruit.

No change has been made as regards the period of sterilisation, which is maintained at 45 minutes. The acidity of the oil has shown no tendency to increase, even though the present practice is to leave a proportion of trash with the fruit to ensure a better recovery of oil.

It is interesting to note that, taken over a period of 8 months, the monthly variation in the figure for the acidity of the oil has not exceeded 0.7 per cent., the weekly variations being also of a similar order. The following figures give the limits in the case of the monthly samples, the acidities being calculated as palmitic acid per cent.

Maximum per cent.	Minimum per cent.	Average per cent.
4.8	4.1	4.5

Digestion of Fruit.

Unlike the closed digester used in the centrifugal process, the digester in the Stork press unit is of an open type. Further, it operates continuously, being maintained full throughout the whole of the working period, sterilised fruit being added at the top as often as a press charge is withdrawn from below. With an open digester the number of variables is therefore reduced to two (*a*) the period of digestion (*b*) the steam pressure in the jacket of the digester.

As regards the period of digestion, a preliminary series of experiments showed that with the digester full, an excess steam pressure of 45 lbs. per square inch in the jacket and the stirring arms making about 30 revolutions per minute, approximately 20 minutes elapsed before a press charge, showing no trace of undigested fruit, could be withdrawn. During this period a considerable amount of oil exuded from the mash and flowed into the trough behind the press.

As soon as the initial digestion had been completed, however, no trouble with undigested fruit was experienced, even though, as explained previously, the digester was maintained under full load. To ensure such a satisfactory digestion experience shows that three stirring arms should be fitted to the vertical shaft of the digester; with only two arms a distinct tendency for undigested fruit to pass through has been noticed.

It was considered unnecessary, therefore, to carry out a special series of experiments in which the period of digestion was varied, since the process can be followed so easily and only a small proportion (one-fifth) of the full charge is removed at one time for pressing.

With regard to the excess steam pressure in the jacket, it was found important to maintain this pressure at a minimum of 45 lbs. per square inch. For this purpose a special gauge was fitted to the steam supply pipe leading to the jacket, the condensed water being drawn off from time to time as required.

This excess steam pressure is much greater than that found necessary for the closed type of digester in the centrifugal plant. Experience shows, however, that the two systems differ considerably as regards the optimum moisture content for the mash.

With the centrifugal system a high steam pressure is not required, since the object of digestion is merely to rupture the oil cells, maintaining the mash as liquid as possible, thereby also facilitating the subsequent expulsion of oil in the centrifugal extraction. In the press system, especially when wet steam is used as the sterilising agent, it is preferable to reduce the moisture content of the mash during digestion in order to ensure a more satisfactory expression of oil. An open digester with a relatively high steam pressure in the jacket is therefore essential, and the jacket of the Stork digester is constructed to withstand an excess steam pressure of over 100 lbs. per square inch.

A considerable reduction in the moisture content of the pericarp is effected when the fruit bunches are sterilised under pressure and a vacuum applied; in fact it is understood that as a result of such treatment the moisture content of the mash can be reduced to such an extent as to affect adversely the expression of the oil. In order to counteract the possibility of the mash becoming too thick and gummy the provision of a perforated ring coil for the supply of live steam to the contents of the digester is recommended by the makers of the plant.

Expression of Oil.

The press method for treatment of the mash differs from the centrifugal process in the following respects (a) the smaller quantity treated per unit charge (b) the possibility of varying the period of expression, thereby ensuring a greater control over the oil content of the pericarp residue.

As regards an individual charge, the quantity of mash amounts to approximately 130 lbs., only about one-fifth of the charge for the centrifugal extractor.

In order to ascertain the variations in the oil contents of the pericarp residue from clean fruit pressed for varying periods, a series of experiments was carried out in which the mash was pressed for 4, 5 and 6 minutes respectively. These periods represented the actual times during which pressure was applied, stop-watch records being taken.

The minimum was fixed at 4 minutes, since with a shorter period of pressing it was found that the pericarp residue was apt to retain a considerable proportion of oil.

Although there is no accumulator so as to ensure a more rapid working of the press, the pumps being worked direct from the engine, the recorder showed almost invariably that the maximum pressure of 350 kilogrammes per square centimetre, (2½ tons per square inch) was attained between 45 seconds and 1 minute after closing the press. This would correspond to the mash being under maximum pressure for approximately 3, 4 and 5 minutes respectively.

The results of the experiments are shown below, the oil contents being calculated in all cases on a moisture-free basis.

Period of pressing minutes	Oil content of residue moisture-free basis per cent.
4	22.5
5	21.3
6	19.7

The figures show clearly that by extending the period of pressing there is a corresponding decrease in the oil content of the residue, calculated on a moisture-free basis. Further, even when pressing for only 4 minutes, the oil content of the pericarp residue is approximately 1 per cent. less than that found for a similar residue from the centrifugal extractor.

As regards the samples taken for analysis, it may be mentioned that these were drawn from larger ones obtained by mixing the whole of the fibrous residue in one of the press cakes from every alternate press charge, the middle cake in the filling always being taken. Since the quantity of fruit treated per day amounts to approximately 6000 lbs. it can be calculated that the figures are based on the results of analysis of a sample drawn from approximately 20 cakes. It is claimed, therefore, that sampling may be considered reasonably representative.

Although, for example, by pressing the mash from clean fruit for a period of 6 minutes the oil content of the residue, calculated on a moisture-free basis, can be reduced to 19.7 per cent., thereby also expressing the greater part of the gummy matters present and facilitating the subsequent separation of fibrous residue and nuts in the screen, the output from one press would be small. Assuming that the press is worked by one labourer and allowing a total period of 1½ minutes to empty and fill the press, the approximate outputs per hour with the periods specified above and allowing 130 lbs. per charge would be approximately as follows :—

Period of pressing minutes	Output per hour lbs. of fruit
4	1360
5	1160
6	1010

When carrying out the efficiency tests it was decided, therefore, to press for only 4 minutes, the output of fruit per hour with that period of pressing being approximately the same as the amount of fruit treated in the same period in the centrifugal process. The capacity of the digester, which is the controlling factor in the centrifugal process, is approximately 700 lbs. of fruit and although digestion is maintained for 30 minutes and a period of 5 minutes must be allowed for emptying and filling the digester, it can be calculated that the net output per hour approximates more closely to a period of pressing of 4 minutes than to 5 minutes.

The actual working of the press calls for little comment except that it is considered somewhat exacting, especially for one labourer. Reference will be made to this point later when discussing the question of labour in the factory.

In view of the slightly lower oil content of the fibrous residue from the press compared with that from the centrifugal extractor, a suggestion was made that it might be economical to treat the residue from the centrifugal extractor in the Stork press, thereby recovering a further quantity of oil.

Experiments showed, however, that pressing would have to be confined to the fibrous portion of the residue, since if the residue from the centrifugal extractor was digested the nuts tended to gravitate to the bottom of the vessel leaving the pericarp residue above.

Although when the fibrous residue was pressed a small amount of oil was recovered, the latter was mostly in the form of sludge, which would involve relatively large losses in purification. Further, on account of the voluminous nature of the fibrous residue, the press could only be charged at a slow rate, so that both from this point of view and that of the small recovery of oil, secondary treatment of the fibrous residue from the centrifugal extractor in the Stork press is not an economical proposition.

Washing of Crude Oil.

The satisfactory separation of the oil from the mixture of oil and water obtained in the press process is slightly more complicated than in the centrifugal system.

If the crude oil is treated with live steam direct the relatively large amount of cellular matter present prevents a clean separation of oil and water. It is necessary, therefore, to dilute the crude oil with water before treatment.

Since the addition of water increases the amount of tank space required to treat a given quantity of crude oil, a series of experiments was carried out to ascertain the minimum quantity necessary to enable the oil and water to separate satisfactorily after treating with live steam for 2 hours and then allowing the mixture to stand for 16 hours. Consideration was given both to the amount of sludge and the oil content of the water that is run to waste.

The results showed that an addition of water equivalent to approximately 40 per cent. of the volume of the crude oil was sufficient to effect a satisfactory separation, and further it was advisable to pump the crude oil into boiling water.

The following procedure was therefore adopted. The number of press charges and the approximate volume of crude oil having been ascertained, the requisite amount of water is placed in the wash tank and brought to the boil, the mixture being then maintained at or near the boiling point until the tank

has received its complement of crude oil. The contents of the tank are then boiled for 2 hours and allowed to settle for 16 hours. For example, it was found that the crude oil from 16 pressings with an additional 12 inches of water, approximately 54 gallons, constituted a full charge for a wash tank.

Although the volume of sludge for a given quantity of oil, using the press system, is usually greater than with the centrifugal system, the sludge layer is well defined and further, the oil content of the wash water is only very slightly greater than that found when using the centrifugal process.

It will be realised, however, that as a result of the addition of water, there is a much greater volume of wash water than with the centrifugal process, so that the proportionate loss of oil in this respect is much greater. Experiments showed that, omitting the sludge, the volumes of washed oil and wash water were in the proportion of approximately 1 to 1.6. The question of the requisite tank capacity for the two systems will be referred to later.

Treatment of Sludge.

The further treatment of the sludge from the wash tank calls for no special comment, the sludge being treated according to the method described for the centrifugal process.

Satisfactory results were obtained, although it was noticed that there was a tendency for the oil content of the residual water from pressed oil to be slightly greater than that of oil from the centrifugal system.

Purification of Oil.

No change has been made as regards the method of purification with the De Laval separator. Equally good results are obtained with the oil from the two systems as the figures from the results of analyses of the latest monthly samples show, one system or other being used continuously throughout the period.

System	Moisture per cent.	Dirt per cent.
Press	... 0.20	Trace
Centrifuge	... 0.17	Trace.

Separation of Pericarp and Nuts.

No difficulty was experienced as regards effecting a satisfactory separation of the fibrous residue and nuts in the screen, in fact, compared with the residue from the centrifugal extractor, there is less tendency, especially with clean fruit, for the spaces between the bars to become choked with fibrous residue, thereby necessitating less frequent cleaning. This is doubtless due partly to the lower

moisture content of the residue (45 to 50 per cent. compared with 50 to 55 per cent. for the residue from the centrifugal extractor) and partly to the larger amount of gummy matter expressed with the oil, leaving therefore a more friable residue for treatment in the screen.

Manufacture of Kernels.

No change has been made in the methods previously described for the drying and cracking of the nuts and the subsequent separation of the kernels from the shell fragments.

As regards the drying of the nuts by storage, experiments have shown that if the pile is only approximately 3 feet high, insufficient heat is developed during 12 days within the pile to reduce the moisture content of the kernels sufficiently to ensure satisfactory cracking. In the case of small quantities of nuts, therefore, the pile was opened after this period and the nuts spread out on the floor of the factory to dry for a further week before cracking. In this way, the proportion of kernels broken on account of insufficient drying was reduced to a minimum. Further, with the nuts stored in a thin layer there was no danger of discoloration of kernel on account of possible local overheating.

The above contingency is, however, unlikely to arise in the case of normal estate factory practice on account of the much larger output of nuts.

The quality of the kernels is satisfactory. The sample taken for analysis from the first consignment shipped showed a small excess of oil, calculated on a 4 per cent. moisture basis, over the standard, 49 per cent., and this slight excess was confirmed as a result of the Liverpool analysis, which showed an oil content of 49.2 per cent., calculated on the sample as received.

The figure of 4 per cent. quoted is an arbitrary choice and has been adopted merely as a basis for judging the oil content on the average moisture content figure quoted in standard literature for palm kernels on arrival in England.

As regards colour, the proportion of off-colour kernels remains approximately the same, *i.e.* 15 to 20 per cent. and in most of those adjudged off-colour it is a case of a tinge rather than an actual discoloration throughout the kernel.

Summary of Process.

Having thus recorded the results of the individual experiments for the various stages it is proposed to summarise the conditions for the whole process. Since, however, the present paper attempts a comparison of the two methods for the treatment of oil palm fruit it seems advisable to include in the summary the details for the various stages of the centrifugal process. Table I includes, therefore, the details for both systems.

TABLE I.

Comparison of Press and Centrifugal Systems.

STAGE OF PROCESS	PRESS SYSTEM	CENTRIFUGAL SYSTEM
<i>Fruit</i>	Loose fruit, well mixed, still containing a small proportion of bunch trash.	
<i>Sterilisation</i>	45 minutes with live steam. The hot fruit should be transferred as quickly as possible to the digester.	
<i>Digestion</i>	20 minutes before withdrawing first press charge, afterwards continuous. Steam pressure in jacket at least 45 lbs. per sq. inch.	30 minutes, 5 lbs. steam pressure in body, 15/20 lbs. steam pressure in jacket for first two charges, 5/10 lbs. for remainder of working day.
<i>Pressing</i>	Mash pressed for 4 minutes, pump pressure approximately 24 tons per sq. inch. Continuous working.	
<i>Centrifugal Extraction</i>		15 minutes, steam injected from 3 minutes after starting to 3 minutes before stopping.
<i>Washing of Crude Oil</i>	Dilution of crude oil with 40 per cent. of its volume of water. 2 hours boiling with live steam, settling for 16 hours. Final proportions of oil and water are approximately 1 of oil to 1.6 of water.	2 hours boiling with steam, settling for 16 hours. Final proportions of oil and water are approximately 2 of oil to 1 of water.
<i>Treatment of Sludge</i>	The sludge is diluted with approximately its own volume of water, the liquid is boiled with live steam for 2 hours after which it is settled for 16 hours.	
<i>Purification of Oil</i>	The washed oil and the oil recovered from the treatment of the sludge are passed through a fine metal gauze filter, heated and run direct to the De Laval separator.	
<i>Treatment of Residue</i>	The pericarp residue is separated from the nuts in a revolving screen. The pericarp residue is used as fuel.	
<i>Treatment of Nuts</i>	The nuts are dried by storage in bins for 12 to 14 days and cracked. The kernels are separated from the shell fragments by treatment of the mixture in a suspension of clay in water. The kernels are washed and dried and bagged; the fragments of shell are washed to free them from adhering clay, dried and used as fuel.	

Efficiency of Process.

In order to make a comparison with the centrifugal system, a series of four efficiency determinations was also carried out with the press system, similar methods for weighing or measuring, sampling and analysis of the waste products being followed in both instances.

Further, the weights of fruit treated in all tests were of same order.

Although an example of the method of calculation has already been worked out when discussing the efficiency of the centrifugal process, an example from one of the press tests is given below in order that losses of oil at various stages may be compared.

FRUIT		lbs.
Weight of fruit treated	...	8421
PALM OIL		
Weight of oil recovered	...	2220
LOSSES OF OIL		
(a) <i>Pericarp residue</i>		
(lbs. of oil per lb. of pericarp residue)		
(i) 1485.5 x .1099	...	163.26
(ii) 817.5 x .1052	...	86.00
(b) <i>Nuts</i>		
(lbs. of oil per lb. of nuts)		
(i) 1524 x .0014	...	21.34
(ii) 1217 x .0008	...	9.61
(c) <i>Washing of crude oil</i>		
(lbs. of oil per gallon of water)		
(i) 122 x .077	...	9.39
(ii) 106.5 x .053	...	5.64
(iii) 99.5 x .072	...	7.16
(iv) 95 x .116	...	11.02
(d) <i>Purification of sludge</i>		
(lbs. of oil per gallon of water)		
(i) 48 x .070	...	3.36
(ii) 78 x .115	...	8.97
Total		325.75
EFFICIENCY OF PROCESS		per cent.
$\frac{2220 \times 100}{2220 + 325.75}$		$\frac{222000}{2546} = 87.2$
OIL CONTENT OF FRUIT		
$\frac{2545.75 \times 100}{8421}$		$= 30.2$

The results show that, commencing with fruit containing a small proportion of trash, approximately 87 per cent. of the total oil present in the fruit has been recovered.

The inclusion of the small proportion of non-oil-bearing trash is reflected in a slightly low figure for the oil content of the fruit.

Although only one example has been quoted, the other three tests, to which reference has already been made, gave results of the same order as are shown by the following figures, which include those for the example worked out :

Amount of fruit lbs.	Efficiency per cent.	Oil content of fruit per cent.	Remarks
6208	85.8	28.4	Fruit with trash
8421	87.2	30.2	Do.
9748	87.5	29.4	Do.
7390	88.2	29.0	Do.

It appears reasonable to assume, therefore, that the efficiency of the press process as described above is approximately 87.2 per cent.

The figure for the oil content of the fruit is of little significance, since the proportion of trash was not known and the weight of clean fruit could not be calculated. The figures merely serve to show that the proportion of trash varied within narrow limits.

As regards the distribution of the losses of oil, figures show that taking the total loss as 100, the percentage distributions are approximately as follows :—

	per cent.
Pericarp residue	... 78.3
Nuts	... 6.8
Purification of oil	... 14.9

Assuming that the average oil content of the clean fruit is 31.5 per cent., the figure found when determining the efficiency of the centrifugal process, it can be calculated that the final distribution of the oil is approximately as follows :—

	per cent.
Oil recovered	... 27.5
Oil lost in pericarp residue	... 3.1
Oil lost on surface of nuts	... 0.3
Oil lost in purification	... 0.6
	<hr/> 31.5

Comparison of Efficiencies of Press and Centrifugal Extractor.

The results of the two sets of efficiency tests serve to show that, as regards recovery of oil, there is little to choose between the two methods. Although the average figure shows a slight superiority in favour of the centrifugal system,

the difference is too small to recommend definitely from this point of view the adoption of the centrifugal in preference to the press system.

From the point of view, therefore, of oil recovery, the writer prefers to regard the two systems as of equal efficiency and to leave the choice of the system to the individual estate, since apart from the question of recovery of oil, other considerations arise which would influence the choice of system. In this connection, it is proposed, therefore, to offer certain observations on the working of the two systems, which the writer wishes to point out are not to be taken as favouring either system. The observations are offered as a result of the numerous trials with both systems carried out at the Government Experimental Plantation, Serdang.

Although as far as the recovery of oil is concerned, the two systems are approximately equal in efficiency, it is interesting to make a comparison of the constituent losses of oil in the two processes. For example, assuming that the average oil content of the fruit is 31.5 per cent. and 88 per cent. of the oil, equivalent to 27.72 per cent. calculated on the fruit, has been recovered, the results of the tests show that the remainder of 3.78 per cent. would be accountable as follows:—

Loss of Oil		Centrifugal system	Press system
Pericarp residue	...	3.30	2.96
Surface of nuts	...	0.23	0.26
Purification of oil	...	0.25	0.56
		<hr/> 3.78	<hr/> 3.78

The figures show clearly that although with the centrifugal system the loss of oil in the pericarp residue is 0.34 per cent. greater than in the press system, this increase is compensated by a corresponding reduced loss in purification.

Similarly, regarded from the point of view of the press system, the figures show that although the loss of oil in the pericarp residue is less than in the centrifugal system, there are increased losses of oil in purification.

Incidentally, the results also show that too much importance should not be attached to the figure for the oil content of the pericarp residue from the point of view of calculating oil recovery, the figure merely serving as a guide to the general efficiency of the process.

To sum up, therefore, the results show that while the recoveries of oil by the two systems are approximately the same, the crude oil recovered by the centrifugal process requires less purification than that obtained by the press system, in other words, the centrifugal system extracts what may be described as a cleaner, crude oil.

As regards the extent to which the results given above can be taken as likely to be reproduced in large factories it is claimed that, while the figures can only be regarded as applying to the fruit as treated in the Serdang factory,

their relatively close agreement can be taken as an indication that results of a similar order would be obtained if larger quantities were treated and chemical control, such as described in this article, were a regular feature of Malayan oil palm factory practice.

For example, it is not considered that pressure sterilisation of bunches would be likely to result in an increased recovery of oil from pressed fruit compared with centrifuged fruit. It is probable that with the coagulation of the greater part of the mucilaginous matter in the pericarp during sterilisation there would be in both cases slightly increased recoveries as compared with the present figures.

Further, it may be pointed out that many of the figures obtained in the experiments at Serdang confirm previous figures obtained as a result of analysing average samples of the same waste products from large factories.

Consideration of Certain Factors affecting Centrifugal and Press Systems.

Among the factors determining the choice of either centrifugal extractor or press for the treatment of oil palm fruit may be mentioned the following: (a) capital cost (b) upkeep (c) labour (d) steam consumption (e) relationship of system to other parts of the plant.

As indicated previously, it is proposed to offer certain remarks regarding these particular factors, the observations being based on the experience gained at Serdang.

(a) *Capital cost.* The present capital cost of a Manlove Alliott digester (5 cwt.) and centrifugal extractor (5 cwt.), together with necessary structural ironwork, is approximately \$5,850 (Straits currency) c.i.f. Port Swettenham. This plant would be of the same capacity as that installed at Serdang and would have an output of approximately 10 cwt. of fruit per hour.

Although this figure may appear somewhat excessive for a plant having such a relatively low output, a plant of double the capacity would only cost approximately \$8,800, in other words for a 50 per cent. increase in price the capacity of the plant would be doubled. The larger plant would comprise a digester (10 cwt.) and 2 centrifugal extractors (5 cwt.).

Owing to the difference in the currency basis of Great Britain and Holland, the latter country being still on the gold standard, the cost of the Stork press has appreciated when calculated on a sterling basis, although the makers of the press have reduced prices in order to meet the changed situation.

Before the change in currency basis, the price of a Stork press, having a capacity of 500 kg. per hour, together with the special type plunger pump capable of supplying two presses of the above capacity, was approximately \$4,900 c.i.f. Port Swettenham. The addition of an extra press unit, thereby doubling the capacity of the plant, raised the price to approximately \$8,100.

Compared with the centrifugal system, the price was, therefore, in favour of the press as the figures in the following table show. Further, an additional advantage was the slightly increased output of the press, when worked for a 4 minute period, referred to previously.

		Price
		\$
Single unit press	...	4,900
Do. centrifuge	...	5,850
Double unit press	...	8,100
Do. centrifuge	...	8,800

As a result of the change in currency basis the price is now slightly in favour of the centrifugal plant, the reduced price of the single press unit being approximately \$6,070. It should be mentioned that in spite of a reduced price the press unit now offered includes a larger stirring kettle than that fitted at Serdang in order to ensure better digestion and consequently more satisfactory oil expression.

While there is relatively only a small price difference between the single units an increase in size of plant favours the centrifugal system, since as far as can be ascertained the price of a double press unit would be approximately \$10,000 compared with \$8,800 for the centrifugal plant.

(b) *Upkeep.* As regards upkeep, the general opinion was that the slow-moving press was likely to be more reliable than the fast revolving centrifugal extractor. Experience at Serdang does not, however, support this contention, the centrifugal extractor having proved more satisfactory to-date than the press in this respect.

Apart from the renewal of one belt after more than two years' wear, the centrifugal extractor has required no special attention; with the press, however, the upkeep has been heavier, since in addition to the replacement of leather washers, constant adjustment of the pump is necessary in order to secure the maximum working pressure being reached as rapidly as possible.

There is no doubt that the frequent adjustment is probably due to the fitter of average ability being unaccustomed to the working of such a relatively intricate machine as a high pressure pump and with more experience better results will be obtained.

The writer has had no experience of the reliability of the press working under estate conditions although, judging from the fact that this system is employed exclusively in Sumatra, it would appear that presses must have given satisfaction.

Although, the factory at Serdang has not been working sufficiently long to enable the writer to offer a considered opinion regarding the reliability of centrifugal extractors, information from estates shows that these machines have given every satisfaction, some of the original "peg-top" extractors, installed more than 6 years ago, being still in use.

(c) *Labour.* As far as can be judged the labour requirements are the same for both systems. For example, at Serdang one labourer works the centrifugal extractor or the press, while with two extractors, each holding 5 cwt., supplied from a 10 cwt. digester, two labourers would be required. This would correspond to one labourer for each press unit.

As stated previously, the actual work with the press is considered more exacting for the labourer, since the work is practically continuous, although on the other hand, the emptying of a centrifugal extractor basket, even with a bottom discharge, is actually heavier work than the charging or discharging of the press.

There is little doubt that from the point of view of output, the weak point of the centrifugal extraction process is its intermittent working and it is hoped that as a result of the determination of the optimum conditions for digestion the makers will endeavour to improve the design of that vessel in order to make the process continuous. This point will be referred to later.

(d) *Steam consumption.* Records have been taken of the consumption of water in the boiler when using both systems. The results have shown that in spite of the admission of live steam to the centrifugal basket during the greater part of the period of treatment, the total consumption of water per ton of fruit treated is slightly less for the centrifugal than the press process, the approximate figures being 2,500 lbs. of water per ton of fruit by the centrifugal process compared with 2,700 lbs. of water when using the the press system.

(e) *Relationship to remainder of factory plant.* As far as a relationship to the rest of the factory plant is concerned, the important parts are the screen for separating the nuts and fibrous residue, and the oil purification plant.

As stated previously, there is less tendency for the spaces between the rods to become choked by the fibrous residue from the press compared with that from the centrifugal extractor. Since, however, the tendency was not particularly marked, even with the latter, the point is of little importance.

As regards the nuts, it is of interest to note that the surface loss of oil is slightly less in the case of nuts from the centrifugal extractor than from the press. This is probably due to the extra steaming which the nuts receive in the course of centrifugal extraction.

As far as the Serdang factory is concerned, the most important difference lies in the oil purification. Reference to the two examples quoted for efficiency shows that while the amount of oil recovered in each test was approximately the same, 2,220 lbs., (about 250 gallons) the volumes of wash water run to waste were 179 gallons for the centrifugal system and 423 gallons for the press system. Allowing, therefore, for the 250 gallons of oil, it will be seen that while the total tank space required for the centrifugal system was approximately the equivalent of 430 gallons the same amount of oil recovered by the press system required the equivalent of approximately 670 gallons, or rather more than a 50 per cent. increase.

Assuming that the method of purification by live steam is used, it can be calculated, therefore, that the centrifugal system requires approximately 33 per cent. less tank space than that which must be provided for the efficient purification of the oil from the press system.

General Observations on Methods of Treatment of Oil Palm Fruit.

When discussing systems for the treatment of oil palm fruit, it must be remembered that with the fall in the price of palm oil during the last two years, the outlook as regards the factory treatment has changed.

Formerly, when palm oil was selling from £35 to £40 per ton, it was economical for large estates to recover as much oil as possible from the fruit; the pericarp residue from the first pressing was, therefore, either treated in a heavier press to recover a further quantity of oil, or was extracted by means of a solvent, thereby recovering practically the whole of the oil. Under such conditions a slight variation in the oil content of the pericarp residue in the original treatment was of little significance owing to the secondary treatment with its additional recovery of oil.

Now that the price of palm oil has dropped to approximately £18 per ton, the secondary treatment of the residue is not economical and the present aim in factory practice is, therefore, to express as much oil as possible in the original treatment, having regard also to speed and simplicity of working. Further, it seems probable that such conditions are likely to hold for some considerable period.

The question therefore arises as to possible improvements in the present methods. As regards the press system it is understood that more powerful presses having a larger unit capacity are being constructed with the object of reducing the oil content of the pericarp residue as much as possible without cracking the nuts.

In the case of the centrifugal system it is probable that the economic size of the basket has been reached. Improvements, however, are possible as regards speeding up the process by modifying the digester design and introducing continuous digestion, bearing in mind that the experiments at Serdang have shown a high excess steam pressure in the jacket to be unnecessary. Further, the possibilities of a continuous centrifugal extraction system should not be overlooked. It is hoped that the manufacturers of the centrifugal plant will, if possible, initiate work in these directions, so that a continuous digestion and extraction process for the centrifugal system may be ultimately realised.

Conclusions.

The results of the investigation indicate that under the present factory conditions at the Government Experimental Plantation, Serdang, the efficiencies of the centrifugal and press systems are of the same order, approximately 88 per cent. of the oil present in the pericarp being recovered.

The figures for analysis show that while the centrifugal system yields a pericarp residue with a slightly higher oil content than that from the press the losses in purification of the crude oil from the centrifugal extractor are correspondingly lower.

Various observations are offered on the working of the two systems at Serdang and the possibilities of effecting improvements are discussed.

Acknowledgment.

The writer wishes to express his appreciation of the assistance which Mr. V. Ramasamy, Factory Assistant has rendered in carrying out the various experiments and the efficiency tests with both systems.

CORRIGENDUM.

Hybridization of Selected Strains of Padi.

Paragraph 6 of the above article on page 532 of the *Malayan Agricultural Journal* of November 1931 should read as follows:—

The ovary of the flower of Radin No. 2 padi is 1 m.m. in length. There does not appear to be any change in size until 21 hours after pollination, when the commencement to enlarge is just perceptible. Twenty four hours after pollination the length of the developing rice grain is 1.25 m.m.
 After 2 days the length of the developing rice grain is 2.50 m.m.
 After 3 days the length of the developing rice grain is 4 to 4.50 m.m.
 After 4 days the length of the developing rice grain is 6 to 6.50 m.m.
 After 5 days the length of the developing rice grain is 7.00 m.m.

After 6 days the husk is fully filled, but the rice is still in the "milk" stage and takes about another 24 days to reach full ripeness.

MALAYAN RICE PRODUCTION 1932.

*Prepared by the Economics Branch of the Department of Agriculture,
S.S. and F.M.S.*

Prices.—The average wholesale prices of rice per picul in Singapore in 1932 were as follows :—Siam rice No. 2 \$3.97, Rangoon rice No. 1 \$3.73, Saigon rice No. 1 \$3.95, while the retail prices of rice in the three principal ports of Malaya of No. 2 Siam rice were, in cents per gantang*—Singapore 30, Penang 34, Malacca 28, as compared with 32, 35 and 31 cents per gantang in 1931.

The price of local padi has varied according to district from 4 cents to 20 cents per gantang. The average price at mill in Krian was 7.5 cents per gantang, as compared with 7.7 cents per gantang in the previous year.

Imports.—As was to be expected in a year when the purchasing power of the labouring classes was much reduced, and on account of the fact that a large number of labourers had returned to India and China, the net imports of rice into Malaya in 1932 shewed a considerable decline over those of the previous year. The following figures set forth the position for the past four years.

TABLE I.
Rice: Malayan Imports and Exports.

YEAR	IMPORTS		EXPORTS		NET IMPORTS	
	Tons	Value \$	Tons	Value \$	Tons	Value \$
1929	785,558	95,461,036	233,897	28,031,407	551,661	67,429,629
1930	800,443	87,666,723	208,688	23,361,561	591,755	64,305,162
1931	691,112	48,458,102	175,385	13,453,189	515,724	35,004,913
1932	592,145	39,729,242	182,515	12,605,402	409,631	27,123,840

In the year under review, of the gross imports of rice into Malaya approximately, 357,000 tons were from Siam, 220,000 tons from Burma, 9,000 tons from French Indo-China and 5,000 tons from British India.

From the above figures it will be seen that the net imports of rice into Malaya in 1932 were 21 per cent. less than in 1931 and 31 per cent. less than in 1930.

The average declared trade value of imports of rice of all kinds into Malaya in 1932 was \$66.21 per ton as compared with \$67.87 and \$108.67 per ton in 1931 and 1930 respectively.

* Imperial gallon.

Malayan Production.—The total area planted with padi in Malaya in the season 1931—32 was 724,980 acres producing a yield of 197,103,000 gantangs of padi equivalent to approximately 291,000 tons of rice. In the previous season the figures were 707,740 acres, producing 175,967,000 gantangs of padi (259,000 tons of rice): an increase over 1931 of 2.4 per cent. in area, and 12.6 per cent. in yield.

TABLE II.

Area of Rice Land Planted in Malaya and Yield of Rice.

SEASON	F.M.S.		S.S.		U.M.S.		TOTAL.	
	Area Acres.	Production Rice Tons.	Area Acres.	Production Rice Tons.	Area Acres.	Production Rice Tons.	Area Acres.	Production Rice Tons.
1929—30	174,466	48,727	67,005	25,659	415,727	77,487	657,198	151,873
1930—31	178,930	55,371	67,350	38,837	461,460	164,858	707,740	259,066
1931—32	194,580	66,517	67,980	38,959	462,420	185,489	724,980	290,965

(Yield estimated on a basis of 686 gantangs padi — 1 ton rice).

In respect of both acreage planted and crop harvested, the figures for the season just concluded constitute a record. The nearest approach to this yield was in the year 1921, when it was estimated that the crop amounted to about 255,000 tons of rice.

It will be noticed that in both these record years Malayan agriculture was in desperate straits: in the former year the low price of rubber coincided with a serious rice shortage; in the past season, the uneconomic price of rubber led the Malay population to return to rice production.

The past season has been assisted by favourable weather for padi cultivation in most areas, which is responsible in a large measure to the increase in average yield per acre of "wet" padi from 277 gantangs per acre in 1931 to 297 gantangs per acre in 1932, and "dry" padi from 87 gantangs per acre in 1931 to 139 gantangs per acre in 1932.

The Federated Malay States area planted increased by 15,650 acres to a total of 194,580 acres, and produced a crop of 45 million gantangs of padi, over 7 million greater than in the previous year. The yield of "wet" padi per acre in this area was 245 gantangs as compared with 237 gantangs in 1930-31 season and "dry" padi, 122 gantangs per acre against 144 gantangs in the previous season.

The area planted and crop obtained in the Straits Settlements was almost identical with that of the previous year.

The Unfederated Malay States showed a satisfactory increase in crop of nearly 14 million gantangs of padi (20,000 tons of rice). The area of land under "wet" rice was 393,470 acres, being 20,600 acres greater than that of the previous year while the dry form of cultivation declined by nearly 19,000 acres. The yield per acre of "wet" padi in the last season was 294 gantangs per acre and of "dry" padi 144 gantangs per acre as compared with 281 gantangs and 77 gantangs respectively in the season 1930-31.

Perhaps the most satisfactory feature of the season is the fact that the area under "dry" padi has declined by 15,000 acres in favour of an increase of 32,000 acres of "wet" padi, a conversion of a temporary cultivation to a system having some permanence.

For the past 14 years, annual production to annual net imports has averaged 50 per cent., while production has amounted to an average of 32 per cent. of local consumption. These figures are also approximately those relating to the year 1931. In 1932 Malayan production has amounted to 73 per cent., of net imports and to 42 per cent. of consumption. The figures for the past five years are as follows:—

TABLE III.
Malayan Percentage Production of Rice to Net Imports
and Consumption.

SEASON	Percentage Production to Net Imports	Percentage Production to Consumption
1928	37	27
1929	34	25
1930	26	21
1931	50	33
1932	73	42

TABLE IV.

Area of Land planted in Malaya and Yields Padi 1931-32.

	WET		DRY		TOTAL	
	Acres	Gantangs	Acres	Gantangs	Acres	Gantangs
F.M.S.						
Perak ...	88,160	24,341,000	14,510	1,725,000	102,670	26,066,000
Selangor ...	20,840	3,264,000	3,260	264,000	24,100	3,528,000
N. Sembilan ...	32,860	9,574,000	370	51,000	33,230	9,625,000
Pahang ...	32,780	5,658,000	1,800	183,000	34,580	5,841,000
Total ...	174,640	42,837,000	19,940	2,223,000	194,580	45,060,000
S.S.						
P. Wellesley ...	32,080	12,175,000	730	232,000	32,810	12,407,000
Penang ...	4,340	2,048,000	—	—	4,340	2,048,000
Dindings ...	130	—	230	57,000	360	57,000
Malacca ...	30,470	11,879,000	—	—	30,470	11,879,000
Total ...	67,020	26,102,000	960	289,000	67,980	26,391,000
U.M.S.						
Johore ...	10,890	1,211,000	8,410	726,000	19,300	1,937,000
Kedah ...	203,270	71,068,000	7,500	1,150,000	210,770	72,218,000
Perlis ...	40,470	11,883,000	—	—	40,470	11,883,000
Kelantan ...	102,840	25,567,000	38,540	5,491,000	141,380	31,058,000
Trengganu ...	36,000	5,963,000	14,500	2,593,000	50,500	8,556,000
Total ...	393,470	115,692,000	68,950	9,960,000	462,420	125,652,000
Total Malaya ...	635,130	184,631,000	89,850	12,472,000	724,980	197,103,000

NOTES:— 1. Areas to nearest 10 acres.

2. Yields to nearest 1,000 gantangs.

Reviews.

Plantation Crops.

Empire Marketing Board 63 pp. H.M. Stationery Office, Kingsway, London, W.C. 2, November 1932. Price 6d. net.

The Statistics and Intelligence Branch of the Empire Marketing Board has compiled a summary of figures of production and trade relating to sugar, tea, coffee, cocoa, rubber, tobacco and spices under the above title.

The Foreword points out that "The course of international trade, always shifting, is to-day undergoing abnormally rapid changes, and the extension of the policy of Imperial Preference in the United Kingdom makes it of special importance that the main statistical facts as to the Empire's trade should be set out clearly and succinctly".

Statistical data of this description is of inestimable value to research workers scattered throughout the world, and it will be of advantage if the Empire Marketing Board would, at regular intervals, publish new editions or appendices which will keep the subject matter up to date.

D. H. G.

Bibliography of Tropical Agriculture 1931.

Published by the International Institute of Agriculture, Rome, Treves, Treccani, Tumminelli, S.S. 32 via Michelangelo Caetani, Rome, Italy 70 pp. 1932. Price 10 Liras.

Until the end of 1930, the Bibliography of Tropical Agriculture appeared under the heading of "documentation" in the *Monthly Bulletin of Technical Information of the International Review of Agriculture*. This feature was discontinued for financial reasons. A generous donation has enabled the Institute to publish the present volume which carries the biographical information to the end of 1931.

Under twelve suitable sections, such as Starch and Sugar Plants, Oil Yielding Plants, Fruits, a notice is given with a succinct statement of contents, of every article published during 1931 that deals with tropical agriculture.

Dr. C. J. J. van Hall, who has contributed this information, has performed a valuable service to tropical agriculture. The Institute states that continued publication is possible only if the Institute can be assured that the sale will be sufficient to cover the cost. The publication deserves the support of agricultural institutions of all kinds and it is to be hoped that the continuity of this work may not be interrupted for the financial reasons which at present threaten it.

D. H. G.

Abstracts.

WORLD INDUSTRY IN COCONUT PALM PRODUCTS.

Abstract of "Survey of Oil Seeds & Vegetable Oils" Vol. II "Coconut Palm Products."

*A summary of Production and trade in the Empire and Foreign Countries.
Prepared by the Statistics and Intelligence Branch of the Empire
Marketing Board. December, 1932. Printed and Published
by His Majesty's Stationery Office, London. 196 pages,
with 8 illustrations and diagrams, price 2s. 0d. net.*

The estimated world's acreage under coconuts in 1930 was about $7\frac{1}{4}$ million acres as compared with $5\frac{1}{2}$ million acres in 1921, an increase of about 30 per cent. during the 10 year period. In both years the British Empire countries accounted for slightly more than half of the world acreage.

World Production and Exports of Copra.

An estimate of the world production of copra based on the figures of acreage and the assumption that $2\frac{1}{2}$ acres of palms yield 1 ton of copra, shows that about 3 million tons of copra are now produced annually. It is estimated that over 40 per cent. of the total production is consumed in the countries of origin.

World exports of copra declined from 1.17 million tons in 1928 to 1.04 million tons in 1930 and, it is stated in this survey, the exports of 1931 were expected to show a further slight decrease. This slight decline is in part due to the increased production of coconut oil in the copra producing areas and to the diminution of prices in the world markets.

Netherlands India and the Philippine Islands supplied nearly 65 per cent. of the whole before the war, whereas they now supply little more than 50 per cent. whilst British Empire countries have increased their combined shares from 20 per cent. to 40 per cent. of the whole. Malaya, in 1930, produced 10 per cent. of the world supplies.

World Exports of Copra and Coconut Oil.

Owing to the rapidly increasing export trade in coconut oil from copra producing countries in recent years, the figures for this commodity should be considered together with those of copra in order to obtain a comprehensive view of the situation. This increasing export of coconut oil indicates that the crushing industries in the copra producing countries are successfully competing with those in the centres of consumption and this tendency may be expected to increase, since labour is generally cheaper in the countries of origin. Furthermore the oil produced from fresh copra has a lower free fatty acid content than

that produced from stale copra which has been stored for lengthy periods. Exports of coconut oil from copra producing areas now exceed 200,000 tons per annum of which the British Empire countries furnish over 20 per cent. The Philippines and Ceylon are by far the chief copra producing countries exporting coconut oil, the former exporting about 60 per cent. of its total copra production as coconut oil.

The total net world exports of both copra and coconut oil in terms of copra* reached a peak of over $1\frac{1}{2}$ million tons in 1929, declining to $1\frac{1}{3}$ million tons in 1930, of which, in 1930, 23.2 per cent. was in the form of coconut oil.

The percentage share of coconut oil in the aggregate exports was 19.8 in 1926, 23.6 in 1927, 22.3 in 1928, 26.4 in 1929 and 23.2 in 1930.

Comparative Exports of Different Countries.

Although Netherlands India is by far the largest exporter of copra, when exports of copra and coconut oil are combined the greatest share of the world supply of both commodities entering international trade is that of the Philippines which was 29.3 per cent. in 1930 as compared with 28.6 per cent. from Netherlands India in the same year. The next most important shares are those of the British South Sea Islands, Ceylon and Malaya which supplied 11.6, 11.1 and 8.7 per cent. respectively.

It is interesting to note that the next most important share of supply of the two commodities is that of the foreign territories of the South Sea Islands which, in 1930, amounted to 3.2 per cent. of the whole.

Principal Copra Importing Countries.

Before the war, Germany was the principal importer of copra with France a close second. After the war, Germany recovered her premier position for a short period but lost it to the United States of America in 1926.

In 1931 net imports of copra in thousand tons, into the principal importing countries were:—United States 192, France 192, Germany 143, Netherlands 85, United Kingdom 80, and Denmark 70 thousand tons.

Consumption of Coconut Oil in the Principal Consuming Countries.

The demand for coconut oil is largely dependent upon the margarine and soap industries and the available figures of margarine production indicate a marked reduction in the past two years. Soap production has been much more stable than that of margarine in recent years and the popularity of hard soaps has resulted in an increasing proportion of coconut and palm kernel oil in the raw material utilised. The utilisation of these two oils in the soap industry is likely to increase if this tendency continues and the choice between the one or the other will be largely decided by their relative price movements.

*65 tons of coconut oil = 100 tons of copra.

The consumption of coconut oil in the principal consuming countries outside the copra producing areas reached a peak of 870 thousand tons in 1929. In 1930 there was a decrease of about 14 per cent. in the consumption and a further decline of about 5 per cent. in 1931.

Other Coconut Products.

Fresh Coconuts. The trade is comparatively small and localised. About 110 million nuts were exported in 1930 for consumption as nuts and for shredding. Jamaica, Ceylon and Malaya are the principal exporters and the United States is the principal importer.

Shredded and Desiccated Coconut. Ceylon and the Philippine Islands are the main sources of supply, about 50 thousand tons being exported from these countries annually.

Coir. Ceylon and India are the chief exporters of this commodity. Exports from the latter country are almost entirely in the form of manufactured products.

Coconut Cake and Meal. The main sources of world supply are Ceylon, India, Netherlands India and the Philippines. The amount exported now exceeds 150 thousand tons.

Demand for Coconut Products in the United States of America.

Coconut oil is by far the most important ultimate product of the coconut palm and the future prospects of the industry depend almost entirely upon the demand for this oil. The war and post-war periods have witnessed a heavy increase in demand which has been largely the result of developments in the United States of America. Since the war that country has been the largest single consumer of this commodity, about one-third of the world's supplies now finding their outlet there. American demand is largely satisfied by Philippine production, and Philippine production is largely absorbed by American demand. Since 1925, Philippine produce has constituted about 80 per cent. of the estimated volume of coconut oil consumed in America, and America has taken between 80 and 90 per cent. of the Philippine exports of copra and coconut oil. It is thus clear that the United States of America and the Philippines, as far as coconut palm products are concerned, constitute almost a self-contained group and that the coconut palm industry outside the Philippines is likely to remain very largely dependent upon European consuming centres as an outlet for its surplus production.

Recently, a further aspect of this question has revealed itself, namely, the effect of a substantial reduction in the American demand for coconut palm products. The decrease in the apparent consumption of coconut oil in the United States during the present depression has released appreciable supplies of Philippine produce for marketing elsewhere, particularly in Europe, since the American consumer can, of course, reduce his demand much

more rapidly than the Philippine producer can reduce his supply. As a result, exports of Philippine copra to France, for instance, increased from an average of about 7,000 tons in the period 1928-30 to 22,000 tons in 1931, and exports of Philippine coconut oil to the United Kingdom increased from an average of about 250 tons in the period 1928-30 to about 14,000 tons in 1931. This development shows that although the United States and the Philippines are largely interdependent as regards coconut palm products, maladjustment between supply and demand can have repercussions on the other producing and consuming areas, and that if American demand fails to keep pace with Philippine production—there were in 1931 over 200,000 acres of coconut palms in the Philippines not yet in full bearing—the European market may find itself subjected to a substantial increase in the offerings of Philippine copra and coconut oil, to the detriment, of course, of marketing possibilities of the produce of other coconut areas.

Demand in Europe.

Since 1924, there has been no evidence of any marked increase in the demand for coconut oil in the European countries taken as a whole. The apparent consumption in the United Kingdom, France, Germany, Denmark, Italy, Norway, the Netherlands and Czecho-Slovakia, which constitute the most important consuming centres of Europe, amounted to about 400,000 tons per annum in the period 1924 to 1927 and about 430,000 tons per annum in the period 1928 to 1931. The development of demand in Europe has been seriously hindered by the increase in supplies of ground nuts and other competing oilseeds, but particularly by the heavy production of whale oil which is largely absorbed in the European margarine and soap industries. Whale oil production increased from 130,000 tons in 1924-25 to 600,000 tons in 1930-31. The serious price fall in whale oil in recent years has resulted in drastic cuts in the whaling plans for 1932-33, the estimated production for which is 300,000 to 400,000 tons, and if these plans materialise the European demand for coconut oil should appreciably benefit.

Future Supplies.

A longer view of the situation suggests that the supplies of coconut palm products should continue to expand as the areas under cultivation, which increased by about 30 per cent. between 1921 and 1930, come into full bearing. Moreover, the world exports of copra and coconut oil in 1930 and 1931 were much below the peak of 1929, thus indicating that supplies could in any case readily respond to an increase in demand. Future supplies are therefore assured, and the expansion of demand is undoubtedly the principal factor upon which the future prosperity of the industry depends. The demand for coconut oil, which, as has already been pointed out, is by far the most important form in which the coconut enters into final consumption, depends on the one hand

on the growth of the soap and of the margarine industries and on the other hand, on the competition of other vegetable oils and fats and animal and marine fats utilised in these industries.

Substitution of Coconut Oil by Other Oils.

The expansion of the soap and margarine industries should continue with the general increase in population and with a resumption of the rise in the standard of living. As regards the substitution of one oil or fat for another in these industries, the prospects are not so easy to define. Substitution is primarily dependent upon the special properties which the competing fats possess and with the widened uses for inferior oils brought about by improvements in technical processes. The large increase in the share of coconut oil in the oleo-margarine industry in the United States of America and its increased utilisation in the soap industry of the United Kingdom in recent years may be attributed to the special characteristics which it possesses and the special qualities which it gives to these commodities. But price considerations also play an important part in the choice of substitutable oils and fats, and over a relatively short period the price factor is probably the more potent. It remains to be seen whether the net results of the efforts being made to reduce the costs of competing vegetable oils and the probable rise in price of animal and marine fats resulting from the restriction in the world's livestock population and the whaling catch will be such as to permit of the more effective competition of coconut oil with substitutable oils and fats such as tallow, palm oil, palm kernel oil, groundnut oil, cottonseed oil and whale oil.

H. D. M.

UTILISATION OF PALM OIL IN THE U. S. A.

*From the United States Tariff Commissioner's Report to the Congress on
Certain Vegetable Oils, Whale Oil and Copra. Report No. 41,
Second Series. 240 pp. Published by the United States
Government Printing Office, Washington,
March 23rd, 1932.*

The above report comprises the results of investigations instituted by the U.S. Government into the cost of production and transportation of coconut oil, copra, palm and palm kernel oil, whale oil and other foreign oils, also a statement of their principle uses in the U.S.A. and of the kinds and amounts of domestic oils and fats replaced in domestic industry by such imports.

The imports of palm oil into the U.S.A. have risen from nearly 42 million lbs. in 1920 to 287 million lbs. in 1930. A further 39 million lbs. of palm kernel oil were imported in the same year. Palm oil is now chiefly imported in bulk from West Africa and Netherlands India. In 1930 the imports from the former country amounted to over 184 million lbs. and from the latter nearly 77 million lbs: a further 9 million lbs. being imported from the United Kingdom, acting as entrepôt for the product from Africa and other countries.

The industries which in the U.S.A. are the principle absorbers of palm oil are those of soap making, tin plating and margarine making, which in 1930 consumed approximately 192 million lbs., 15 million lbs., and 0.86 million lbs. respectively. The consumption of palm kernel oil in the soap making industry in 1930 was 29 million lbs: approximately 10 million lbs. of this oil was also used for edible purposes.

Replacement of Foreign by Domestic Oils.

The report states under the heading of aspects of the question of replacement of foreign by domestic oils that practically the whole of the 192 million lbs. of palm oil used in the soap industry may be taken as being technically interchangeable with domestic inedible tallow.

Coconut and palm oil, however, which form a large fraction of the now increasingly popular kinds of soap, such as hard toilet and most white laundry soaps which lather quickly and profusely even in cold hard water, cannot be greatly reduced or replaced by other animal or vegetable oils without making a material change in the character of these soaps.

For the use of palm oil in the manufacture of tin plate, for which as already stated, 15 million pounds are consumed annually, no satisfactory substitute has so far been developed on a commercial scale.

Increased Home Production of Oils.

The report states that a reduction of imports of vegetable oils would, to a considerable extent, be offset by an increase in domestic production of their substitutes or a decreased export of these substitutes.

The four principle sources of home produced oils which are used as food and soap oils are oleo-oil, cotton seed, corn and peanut.

It is not considered likely that increased demands for oleo-oil (a by-product of the beef industry) and tallow would be merely met by an increasing production of cattle, sheep and hogs since the price of meats, the major product, would be a more important consideration than that of oils. An increased demand for the latter might, however, result in such changes in methods of animal feeding as would result in a greater proportion of fat, but whether this would prove profitable or popular, is, the report states, uncertain, as such change would affect the character of the meat sold and not merely add to its oil content.

A further possible means of increasing the supply of animal fats lies in a reduction of their wastage which could undoubtedly be carried out if prices were high enough to justify the effort.

An increased production of whale oil is not anticipated as the supply of whales in the region to which American whalers at present confine their operations, appears to be approaching exhaustion.

Any increase in the production of cotton seed would involve a corresponding increase in that of cotton and thus affect the price of cotton.

Since corn oil is extracted from the germ of the corn grain and only a limited amount of corn is treated in such a way that the germ is removed, it is unlikely that any notable increase in this oil could be produced to meet an increased demand.

In the case of the peanut, which is grown in the U.S.A. chiefly for use as a food or for conversion into peanut butter, it is questionable whether it would be profitable to grow large quantities of this crop for the primary purpose of extracting the oil and its joint product, oil cake.

It would appear from the foregoing that although the tendency is for the U.S.A. to seek to reduce its imports of foreign oils by a correspondingly increased production of domestic oils, the problem is not a simple one, since all such oils are at present merely the by-products of other industries.

H. D. M.

Departmental.

FROM THE DISTRICTS.

The Weather.

Weather generally throughout the country was very dry, the recorded rainfall being below the average in most cases. Much of the west coast area especially the Malacca-Johore region was without rain for the first three weeks of the month. During the last week local showers were experienced over most of the country. The contrast between the rainfall of January and February is very noticeable on the East of the main range, for example, the January total for Pekan or Kuantan was approximately 20 inches, while the February total was less than 2 inches. This is considerably below the normal February precipitation for these Stations.

Remarks on Crops.

Rubber.—Prices paid for kampong rubber declined still further during the month, the range throughout all districts being from \$4 to \$8 per picul for smoked sheet. Unsmoked sheet was sold at \$3 to \$6.80, and scrap at \$1 to \$4 per picul.

The dry weather caused a general and heavy wintering of rubber during the month. Tapping was thus somewhat reduced. As padi harvests were also in progress in many districts the attention of the cultivators was turned to this and tapping in the neighbourhood of such areas was almost wholly suspended. In districts where little or no padi is grown and the cultivator is dependent solely on rubber, tapping was as heavy as usual.

The dry weather combined with reduced tapping activity caused a general decline of mouldy rot. As the new flush of leaves appeared during the last week of the month cases of *Oidium* were to be expected, but so far only two isolated cases have been reported from Johore.

Padi.—In most districts the harvesting of padi was largely completed during the month, and preliminary reports show that the crop obtained is generally well above the average, except where late planting is practised. In such areas the dry weather occurred too soon and the crops harvested will be below average. With the heavy new crop, prices of padi at the Bagan Serai Mill remained stationery at \$1.62 per picul, the figure to which they dropped during last month. It is reported that Chinese millers in the Krian District are having difficulty in purchasing supplies of padi as they cannot offer better prices than the Government Mill.

It is noteworthy that an increase over last year's crop of about a million gantangs is reported from the Temerloh District. This should allow a large surplus for export from the District to other parts if the difficulty of cost of transport can be overcome. With regard to trials made in Selangor to produce

two crops of padi in one year it is satisfactory to record that at Rasa 580 gantangs per acre were obtained from two crops, one reaped in July, 1932, and one in February, 1933. This compares very favourably with a total yield of 150 gantangs from one crop in the 1931 - 32 season on the same land although the crop for that season was probably below normal from various causes. New import duties on padi and rice entering Kedah have come into force, an Empire preference of 10 cents per picul being allowed. Duty on foreign rice and padi is 25 cents per picul. An effort is being made in one mukim in Province Wellesley, in conjunction with the Co-operative Officer, to bulk the padi from a number of growers and sell direct to Penang in the expectation of the growers receiving a higher price than that offered by the local middlemen.

Coconuts.—The price of fresh nuts has generally declined slightly over the whole country, probably largely owing to a decrease in demand following Malay and Chinese holidays.

Progress in the improvement of small-holders' kilns and in the quality of copra manufactured continues. The Assistant Chemist for Copra Research visited Province Wellesley and reported very favourably on the kilns both at Tassek Chempadek and Sungei Acheh and the copra produced on them. In the Sabak Bernam District of Selangor, enthusiasm continues, a slight decline in the general price of copra being to some extent offset by the enhanced price of well-prepared copra. Several more copra groups with a common kiln have been formed in this District. At Temerloh a Malay built clay kiln has been completed and production of copra is expected to follow shortly, samples of which will be forwarded to headquarters for examination and report by the Assistant Chemist for Copra Research.

Tobacco.—A block of 30 acres is under tobacco cultivation at Lenggong (Perak) where local cheroots are being manufactured. Smaller blocks aggregating 18 acres are being planted up in the Baling and other Districts of Kedah.

Padi Experiment Stations and Test Plots.

Reports indicate that harvesting of padi is now well advanced or finished on the majority of Padi Plots and at the Padi Experiment Stations. Crops reaped have been generally satisfactory. In certain cases bird damage has caused fairly heavy losses, particularly at Kamunting (Perak) and Rembau.

The construction of the main drain for the Bachang Irrigation Scheme in Malacca has necessitated the removal of the pumping plant on the Pulau Gadong Padi Station. A larger and more efficient pump will be installed before the next planting season.

DEPARTMENTAL NOTES.

Tour of the Director of Agriculture.

Dr. H. A. Tempany, C.B.E., Director of Agriculture, S.S. and F.M.S. visited Kelantan from the 5th to 10th of February at the invitation of the Government of Kelantan, with the object of reporting on the conditions of the agricultural services in that State. During the tour he visited a number of parts of Kelantan in company with the Principal Agricultural Officer and discussed numerous problems. The Director's report of his visit has been submitted to the Kelantan Government.

Marketing of Peasant Produce.

The liaison committee between the Agricultural and Co-operative Departments and the Rubber Research Institute, referred to under this heading in the Departmental Notes of the previous month, has now been established. This committee comprises the membership of the Director of Co-operation, the Director of Agriculture, the Director, Rubber Research Institute, the Chief Agricultural Field Officer, the Agricultural Economist, the Assistant Director of Co-operation, North and the Assistant Director of Co-operation, South.

The establishment of this committee constitutes an important step forward in relation to the organisation of efforts to improve the conditions of the marketing of peasant produce.

Two meetings of this committee have already been held at which various questions such as District Economic Boards, village fairs, improvement in the marketing of poultry, programmes for the propaganda and lecture caravan and allied subjects were discussed. It appears likely that the functions of the Committee will lead to useful results in connection with this important problem.

Agricultural Advisory Committee.

A meeting of the Agricultural Advisory Committee was held at the head office of the Department of Agriculture, in Kuala Lumpur on February 16th whereat all members of the Committee were present with the exception of Mr. Choo Kia Peng, C.B.E and Mr. R. M. E. Michaux.

At the meeting various subjects were discussed, these included :—

Copra.—The Committee was informed that the Government of the Federated Malay States has accepted their recommendation that the services of the Assistant Chemist for Copra Investigations be continued.

It was stated that this officer is now engaged on the preparation of a bulletin on copra which will summarise the whole of his work up to date.

Tobacco.—The meeting was informed that a Committee with the Commissioner, Trades and Customs as Chairman, has reported to Government fiscal measures which should be adopted in view of the extension of tobacco cultiva-

tion in Malaya, having regard to the prevention of undue loss of revenue while encouraging the development of this industry.

The Chairman stated that he is sanguine that yellow tobacco of a type suitable to replace leaf now imported for the manufacture of lower grade cigarettes can be produced and cured in Malaya, but that it is necessary that definite proof of this should be obtained before propaganda for its cultivation can be started. The Committee was informed that locally grown cheroot tobacco has been proved to be of equal quality to that imported from Burma but that there is considerable difficulty in dealing with this trade since the local market could easily be overstocked.

It is estimated that the total area under tobacco in Malaya at the end of 1932 was 4,745 acres.

Mouldy Rot.—The Committee was informed that the Department of Agriculture has recommended to Government that the sale of disinfectants should be carried out by District Officers and Malay head men and that this recommendation is still under consideration by Government. The Committee was informed that the possibility of employing non-proprietary chemicals for the treatment of mouldy rot is under consideration by the Rubber Research Institute.

Poultry.—The Committee was informed that the Department of Agriculture has held intensive discussions with the Co-operative Department and with Government on the question of the encouragement of poultry raising, from which it has emerged that three useful avenues for work exist.

- (1) The organisation of distribution of poultry and eggs. Schemes for the sale of eggs already exist, sponsored by the Co-operative Department.
- (2) Provision of instruction for the small producer on better methods of handling poultry and
- (3) Treatment and prevention of disease.

General.—The Committee unanimously concurred with the suggestion that there should be two Malay members of the Agricultural Advisory Committee instead of only one Malay member as hitherto.

Leave.

Mr. D. H. Grist, Agricultural Economist and Editor, S.S. and F.M.S. has been granted 10 months and 10 days leave on full pay with effect from 23rd February, 1933. Mr. A. Thompson, Acting Mycologist, has been appointed to act for Mr. Grist during his absence.

Notification of *Oidium Heveae*.

During the forthcoming wintering season and refoliation of the rubber trees of Malaya the Rubber Research Institute desires the co-operation and help of all estate managers in an endeavour to determine the extent and virulence of the disease known as Leaf Mildew or "Abnormal Leaf Fall" caused by the fungus *Oidium-Heveae*. Steinm.

The symptoms of the disease are briefly as follows :—

The fungus is most active during the refoliation period. The young leaves of the rubber tree become infected by spores which develop a creeping surface mycelium bearing upright sporulating structures. Patches of the sporulating fungus may be felt, or seen as a thin glistening film on the underside of the leaf when viewed obliquely.

The midrib of the young leaf is most favoured by the fungus and from the lowest point of infection to the tip, the leaf rapidly becomes shrivelled, dull, browned in patches, and blackened. It eventually falls off, the leaf stalk remaining attached to the tree. The flowers also may be attacked, fall off and thereby greatly reduce the seed harvest.

In this connection, the Institute would be grateful if managers who observe the young leaf to be falling from rubber trees on their estates, would pick from the tree a number of whorls of sickly leaves and flowers and forward them direct to the Institute for examination. Such specimens should be packed loosely in a tin or a cardboard box, it is not necessary to damp them unless they have to travel a long distance, in which case a piece of wet blotting paper should be placed at the bottom of the box.

As much information as possible should be given, such as rainfall for the past three months, age of trees affected, number of defoliations of individual trees observed, type of soil, drainage, whether manured or not and if yield is affected in any way differently from that usually experienced during wintering. Any other relevant information will be appreciated.

Statistical.

MARKET PRICES.

February, 1933.

Rubber.—The highest price recorded in Singapore during February for rubber smoked sheet, equal to London Standard was 6 6/16 cents per lb. on from the 3rd to 14th, and the lowest price 6.0 cents on 28th. The average price for the month was 6.25 cents per lb. in Singapore, 2.06d. London and 2.87 cents gold New York, as compared with 6.75 cents, 2.28d. and 30.1 cents gold respectively in January 1933.

Palm Oil.—The course of the English market during the month of February, on a basis of 18 per cent. f.f.a., c.i.f. Liverpool, was as follows; 2nd, £13.17.6 per ton; 9th, £15.10.0 nominal; 16th, £16.0.0 nominal; 23rd, £13.15.0. Prices in the U.S.A. landed weight c.i.f. New York/Philadelphia, were 2.15 cents gold per lb. on 8th, and 2.00 cents gold on 22nd of the month.

Palm kernels, Fair Average Malayan Quality, c.i.f. landed weight on the Continent realised 9 shillings per cwt. on the 22nd of February.

Copra.—The highest Singapore price for sundried during February was \$4.95 per picul in the middle of the month, falling to \$4.40 per picul at end of month, the average price being \$4.74 per picul as compared with \$5.16 in January. The mixed quality averaged \$4.32 as compared with \$4.72 in the previous month.

Copra cake averaged \$2.05 per picul.

Coffee.—The prices at Singapore for Sourabaya coffee remained steady, averaging \$25.40 to \$27.50 per picul, the price within the range depending upon quality.

Palembang coffee averaged \$20.40 per picul as compared with \$19.75 in January.

Arecanuts.—Palembangs averaged \$2.25 per picul and Bila Whole averaged \$2.49 as compared with \$2.75 and \$2.69 per picul respectively in January. Singapore average prices for other grades were :—Split \$3 to \$5.09, Red Whole \$4 to \$4.75, Sliced \$5.94 to \$7.25 per picul, the price within each range depending on quality.

Rice.—The following are the average wholesale prices per picul of rice in Singapore during January :—Siam No. 2 \$3.40, Rangoon No. 1 \$3.24, as compared with \$3.65 and \$3.20 per picul during December. The average retail market prices in cents per gantang of No. 2 Siam rice in January were :—Singapore 25, Penang 29, Malacca 27, as compared with 28, 30 and 27 cents respectively in December.

Gambier.—Block Gambier has remained steady throughout the month at \$5 per picul and Cube at \$8 per picul. The average prices during January were Block \$5 and Cube \$8.75.

Pineapples.—Prices have remained practically unchanged, the average Singapore prices per case in February being :—Cubes \$3.19, Sliced Flat \$2.90, Sliced Tall \$3.21, as compared with \$3.20, \$2.97 and \$3.34 respectively during January.

Tapioca.—There has been a good demand and prices have been firm. Pearl seed appreciated by \$1 per picul towards the end of the month, the average price per picul being \$5.25 as compared with \$4.60 during January.

The price of Flake averaged \$4.84 as compared with \$4.10 in January and Pearl medium averaged \$5.44 as compared with \$4.75 in the previous month.

Sago.—Pearl small fair remained at the same price as in the previous month, viz. \$3.90. Flour Sarawak Fair averaged \$1.94 as compared with \$2.01 in January.

Mace.—Prices, more or less nominal, are quoted at \$62 per picul for Siouw and \$40 for Amboina.

Similar prices have ruled for the past three months.

Nutmegs.—The average Singapore prices per picul for 110's were \$21.25 per picul and 80's \$25.12 per picul, as compared with \$25 and \$26.50 per picul respectively during January.

Pepper.—Prices have shown a still further decline as compared with those of January. Singapore Black averaged \$15.50 per picul, Singapore White \$19.75 and Muntok White \$20.06 during February, the corresponding prices for January being \$16.62, \$20.31 and \$20.69 respectively.

Cloves.—There has been no demand for cloves, nominal prices being quoted at \$40 for Zanzibar and \$45 per picul for Amboina.

The above prices are based on London and Singapore daily quotations for rubber; the Singapore Chamber of Commerce Weekly Reports for the month and on other local sources of information. Palm oil quotations are kindly supplied by Messrs. Cumberbatch & Co., Ltd. and Messrs. Guthrie & Co. Ltd., Kuala Lumpur, and the Singapore prices for coffee and arecanuts by the Lianqui Trading Company of Singapore.

1 picul = 133½ lbs. The Dollar is fixed at 2s. 4d.

Note.—The Department of Agriculture will be pleased to assist planters in finding a market for agricultural products. Similar assistance is also offered by the Malayan Information Agency, 57, Charing Cross, London, S.W. 1.

GENERAL RICE SUMMARY.*

January, 1933.

Malaya.—Gross foreign imports of rice (including stocks available for re-export) during January, 1933, amounted to 48,972 tons, as compared with 51,021 tons in January, 1932, of which 49 per cent. was consigned to Singapore, 24 per cent. to Penang, 7 per cent. to Malacca, 18 per cent. to the Federated Malay States and 2 per cent. to the Unfederated States.

Of these imports 64 per cent. were from Siam, 34 per cent. from Burma, 1 per cent. from Indo-China and 1 per cent. from other countries.

Total foreign exports of rice from Malaya in January, 1933, were 14,120 tons (including 177 tons local production) as compared with 16,684 tons in January 1932, a fall of 15 per cent.

Of these exports 83 per cent. was consigned to Netherlands India and 17 per cent. to other countries.

India and Burma.—Total foreign exports of rice during December, 1932, were 109,000 tons as compared with 100,000 tons in November, 1932, and 151,000 tons in December, 1931, an increase of 9 per cent. in respect of the previous month and a decrease of 28 per cent. in respect of the same period in the previous year.

Total exports during the period January to December, 1932, were 2,075,000 tons as compared with 2,092,000 tons for the corresponding period of 1931.

Exports of rice and bran from Burma during January 1933, amounted to 167,906 tons, as compared with 291,541 tons for the corresponding period of 1932, or a decrease of 42.4 per cent. The final forecast of the padi area in Burma for the season 1932 - 33 is estimated at 12,290,000 acres, an increase of 3 per cent. as compared with the actual acreage for 1931 - 32.

The yield of padi is estimated at 7,362,500 tons, an increase of 17 per cent. as compared with the actual figures for 1931 - 32. The surplus available for export is estimated to be 4,662,000 tons, an increase of 28 per cent. as compared with the actual surplus of 1931 - 32.

Japan.—The area under padi during 1932 was 7,981,000 acres yielding 8,470,000 tons as compared with 7,959,000 acres and 7,744,000 tons during 1931, an increase of 0.3 per cent. in area and 9.4 per cent. in yield.

The actual crop for the the year 1932 totalled 8,470,000 tons and the amount held over between the 1932 season 1,249,000 tons.

Total imports are estimated as follows:—Korean rice 982,000 tons, Formosan 421,000 tons and Foreign 140,000 tons.

The consumption of rice for 1933 is estimated to be 10,011,000 and the estimated exports, 84,000 tons.

*Abridged from the Rice Summary for January, 1933, compiled by the Department of Statistics, S.S. and F.M.S.

Siam.—The exportable surplus available for export is now estimated at 1,570,000 tons of rice and rice products.

French Indo-China.—Entries of padi at the port of Cholon during January, 1933, amounted to 72,000 (metric) tons, a decrease of 11 per cent. as compared with the same period of 1932.

Exports of rice from Saigon in January 1933, totalled 74,000 tons, a decrease of 5 per cent. as compared with January 1932.

Owing to a severe drought during the period of transplanting, the production in the season 1932-33 is expected to be small. The surplus available for export from Saigon this year is estimated at 1,132,000 tons.

Ceylon.—Imports during the period January to December, 1932, totalled 441,952 tons, a decrease of 1 per cent. as compared with the same period of 1931.

Of these imports 19.5 per cent. were from British India, 69 per cent. from Burma, 4 per cent. from the Straits Settlements and 11.1 per cent. from other countries.

Europe and America—Quantities of rice shipped from the East were:—

- (a) To Europe for the period January 1st to January 26th, 1933, 80,971 tons, an increase of 116.5 per cent. as compared with the same period of 1932. Of these 1933 shipments 39 per cent. were from Burma, nil from Japan, 54 per cent. from Saigon, 6 per cent. from Siam and 1 per cent. from Bengal, as compared with 75 per cent. from Burma, nil from Japan, 22 per cent. from Saigon, 3 per cent. from Siam and nil from Bengal in the same period of 1932.
- (b) To the Levant, period January 1st to December 30th 1932, 49,192 tons, a fall of 27 per cent. as compared with the same period of 1931.
- (c) To America and the West Indies for the period January 1st to December 7th, 1932, 126,277 tons, a decrease of 19 per cent. as compared with the same period of 1931.

Italy.—The area under rice during the season 1932-33 was 335,000 acres as compared with 359,000 acres in 1931-33, a decrease of 6.7 per cent.

Production in 1932-33 was 646,000 tons as compared with 652,000 tons in 1931-32, a decrease of 0.9 per cent.

United States of America.—The area under rice in 1932-33 was 869,000 acres yielding 791,000 tons, a decrease as compared to the figures for 1931-32 of 10.4 per cent. in area and 12.5 per cent. in yield.

ACREAGE UNDER OIL PALM IN MALAYA, WITH ANNUAL
PLANTINGS TO END OF 1932.

STATE	1917 or earlier	1918	1919	1920	1921	1922	1923	1924	1925	1926	1927	1928	1929	1930	1931	1932	Total	Reserve Land
Perak	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Selangor	215	213	229	651	598	443	1,891	1,575	1,316	503	1,441	2,797	4,375	7,863	183	10	17,372	7,248
Negri Sembilan	—	—	—	—	—	—	—	—	—	1,830	1,435	886	1,012	645	141	235	13,315	5,588
Pahang	—	—	—	—	—	—	—	—	—	504	—	—	100	170	166	233	1,173	2,578
	—	—	—	—	—	—	—	—	—	—	—	592	95	101	—	—	788	348
Total F.M.S.	215	213	229	651	598	443	1,891	1,775	1,316	2,837	2,876	4,275	5,582	8,779	490	478	32,648	15,762
Johore	—	—	—	—	—	—	—	—	1,043	1,271	2,612	1,509	2,293	10,300	5,375	3,374	27,777	33,002
Kelantan	—	—	—	—	—	—	—	—	—	—	—	—	—	—	600	—	600	650
Total U.M.S.	—	—	—	—	—	—	—	—	1,043	1,271	2,612	1,509	2,293	10,300	5,975	3,374	28,377	33,652
Total Malaya	215	213	229	651	598	443	1,891	1,775	2,359	4,108	5,488	5,784	7,875	19,079	6,465	3,852	61,025	49,414

**ACREAGE OF TAPPABLE RUBBER OUT OF TAPPING ON ESTATES OF 100
ACRES AND OVER, MALAYA, AT THE END OF JANUARY, 1933.**

STATE OR TERRITORY	Acreage of Tappable Rubber end 1931	ESTATES WHICH HAVE ENTIRELY CEASED TAPPING		ESTATES WHICH HAVE PARTLY CEASED TAPPING		Total (3) + (5)	Percentage of (7) to (2)
		Acreage (3)	Percentage of (3) to (2) (4)	Acreage (5)	Percentage of (5) to (2) (6)		
FEDERATED MALAY STATES :—							
Perak	250,951	13,248	5.3	31,705	12.6	44,953	17.9
Selangor	308,379	18,092	5.9	37,324	12.1	55,416	18.0
Negri Sembilan	228,541	18,804	8.2	21,973	9.6	40,777	17.8
Pahang	38,141	8,426	22.1	4,595	12.0	13,021	34.1
Total F.M.S.	826,012	58,570	7.1	95,597	11.6	154,167	18.7
STRAITS SETTLEMENTS :—							
Province Wellesley	44,734	2,019	4.5	8,637	19.3	10,656	23.8
Dindings	6,969	310	4.4	1,128	16.2	1,438	20.6
Malacca	111,780	5,548	5.0	21,885	19.6	27,433	24.5
Penang Island	1,635	1,058	64.7	79	4.8	1,137	69.5
Singapore Island	28,269	12,770	45.2	3,936	13.9	16,706	59.1
Total S.S.	193,387	21,705	11.2	35,665	18.4	57,370	30.0
UNFEDERATED MALAY STATES :—							
Johore	313,385	42,769	13.6	33,293	10.6	76,062	24.3
Kedah (a) (c)	114,254	11,114	9.7	7,112	6.2	18,226	16.0
Kelantan	21,175	9,692	45.8	1,721	8.1	11,413	53.9
Trengganu (b)	4,352	Nil	Nil	2,072	47.6	2,072	47.6
Perlis (c)	957	106	11.1	502	52.5	608	63.5
Total U.M.S.	454,123	63,681	14.0	44,700	9.8	108,381	23.9
TOTAL MALAYA	1,473,522	143,956	9.8	175,962	11.9	319,918	21.7

Notes :— (a) Registered companies only and are rendered quarterly.

(b) Registered companies only.

(c) The figures quoted for Kedah and Perlis are those for September and December 1932, respectively, revised figures will be published when available.

(d) Figure for end December, 1932 is not yet available.

TABLE I
MALAYA RUBBER STATISTICS
STOCKS, PRODUCTION, IMPORTS AND EXPORTS OF RUBBER, INCLUDING LATEX, CONCENTRATED LATEX AND REVERTEX.
FOR THE MONTH OF JANUARY, 1953 IN DRY TONS.

Territory	Stocks at beginning of month 1			Production by Estates of 100 acres and over		Production by Estates of less than 100 acres and over estimated 2		Imports			Exports including re-exports			Stocks at end of month			
	Ports	Dealers	Rates acres and over	January 1933	during the month	January 1933	during the month	Foreign	From States	From Malayan	Foreign	Local	Foreign	Local	Ports	Dealers	Estates of 100 acres and over
MALAY STATES :—																	
1																	
Federated Malay States	...	14,718	13,273	11,526	8,180	8,180	8,180	Nil	Nil	Nil	14,675	5,967	14,675	5,967	...	13,980	13,052
Malacca	...	5,697	1,512	1,369	1,369	1,369	1,369	9	9	9	3,932	...	3,932	...	...	6,494	1,513
Penang Wellesley	...	145	593	595	595	595	595	Nil	Nil	Nil	...	...	...	...	...	1,057	704
Dindings	...	33	86	101	101	2,199	2,199	16,121	16,121	16,121	7,809	...	7,809	...	...	26	130
Penang	...	2,231	5,046	10	2	2	2	5,400	5,400	5,400	...	...	...	...	...	1,538	6,344
Singapore	...	3,827	19,823	215	135	135	135	5,608	5,608	5,608	18,053	...	18,053	...	...	4,473	16,824
Total Settlements	6,958	30,744	2,416	2,202	2,202	2,199	2,199	6,157	6,157	6,157	29,794	...	29,794	...	6,011	29,735	2,528
TOTAL MALAYA	6,958	49,189	21,777	19,716	19,716	19,716	19,716	6,157	6,157	6,157	46,559	16,086	46,559	16,086	6,011	47,062	21,517
SEMITTMENTS :—																	
Malacca	...	5,697	1,512	1,369	1,369	1,369	1,369	9	9	9	3,932	...	3,932	...	...	6,494	1,513
Penang Wellesley	...	145	593	595	595	595	595	Nil	Nil	Nil	...	...	...	...	...	1,057	704
Dindings	...	33	86	101	101	2,199	2,199	16,121	16,121	16,121	7,809	...	7,809	...	...	26	130
Penang	...	2,231	5,046	10	2	2	2	5,400	5,400	5,400	...	...	...	...	...	1,538	6,344
Singapore	...	3,827	19,823	215	135	135	135	5,608	5,608	5,608	18,053	...	18,053	...	...	4,473	16,824
Total Settlements	6,958	30,744	2,416	2,202	2,202	2,199	2,199	6,157	6,157	6,157	29,794	...	29,794	...	6,011	29,735	2,528

TABLE II
CHECKS, IN DRY TONS 7

DISTRIBUTION OF RUBBER IN DRY STATES						
Class of Rubber	Federated Malaya States	Singapore	Penang	Province of Dutch Malesia	Johore	Total
20	21	22	23	24	25	26
DRY RUBBER	10,742	15,869	4,375	7,371	990	39,347
WET RUBBER	3,378	1,455	459	206	1,443	6,801
TOTAL	13,980	16,924	5,334	7,577	2,333	46,148

TABLE III
FOREIGN EXPORTS 4

PORTS	For month	January 1933
Singapore	27,140	27,140
Penang	1,516	11,516
Port Swettenham.	7,253	7,253
Malacca	690	690
MALAYA	46,599	46,599

TABLE IV
DOMESTIC EXPORTS

AREA	For month	January 1983
Malay States	39,623	39,623
Straits Settlements	...	...
MALAYA	39,623	39,623

Notes.—1. Stocks on estates of less than 100 acres and stocks in transit on rail, road or local steamer are not ascertained.

2. The production of estates of less than 100 acres is estimated from the formula: $\text{Production} \div \text{Imports} + \text{Stocks at beginning of month} - \text{Exports} + \text{Stocks at end of month} + \text{Consumption}$. *i.e.* Column [7] = Column [18] + [14] + [17] + [18] + [19] + [19A] + [2] - [3] - [4] - [5] - [9] - [10]. For the Straits Settlements, Columns [7] and [8] represent purchases by dealers from local estates of less than 100 acres, reduced by 15% of duty rubber.

3. Dealers' stocks in the Federated Malay States are reduced to duty weights by the following fixed ratios: unsmoked sheet, 15%; wet sheet, 25%; scrap, lump, etc., 40%; stocks elsewhere are in duty weights as reported by the dealers themselves.

4. Domestic exports are estimated by deducting the average monthly duty weight of foreign imports over a period of 2 months from the gross foreign exports. The above estimates of exports and imports of rubber for the Federated Malay States being domestic production.

5. The above, with certain omissions, is the Report published by the Registrar-General of Statistics, S.S. and F.M.S., at Singapore on 21st of February 1933.

Locality	AIR TEMPERATURE IN DEGREES FAHRENHEIT										EARTH TEMPERATURE		RAINFALL							BRIGHT SUNSHINE				
	Means of					Absolute Extremes					At 1 foot	At 4 feet	Total		Most in a day	Number of days				Total	Daily Mean	Per cent		
	A.	B.	Min.	Max.	Mean of A and B	Lowest	Lowest	Highest	Highest	in.			mm.	Precipitation, .05 in or more		Thunderstorm	Fog morning obs.	Gale force 8 or more						
	°F	°F	°F	°F	°F	°F	°F	°F	°F	°F	°F	°F	in.	mm.	Amt.					hr.	hr.	%		
Railway Hill, Kuala Lumpur, Selangor	88.9	71.8	80.3	92	69	76	74	83.3	84.0	83.3	84.0	1.46	6.10	154.9	18	14	3	11		182.35	5.88			
Bukit Jeram, Selangor	86.9	72.1	79.5	89	70	77	74	82.8	85.1	82.8	85.1	2.04	11.98	304.3	21	17	11	3		201.30	6.49			
Sitiawan, Perak	88.6	72.7	80.7	92	69	85	75	83.3	84.0	83.3	84.0	1.49	8.30	210.8	21	18	4	3		184.60	5.95			
Kroh, Perak	84.0	68.7	76.3	87	64	77	71	79.0	80.5	79.0	80.5	1.55	3.52	89.4	19	11				204.35	6.59			
Temerloh, Pahang	84.1	71.9	78.0	89	66	75	74	82.4	84.1	82.4	84.1	2.50	10.22	259.6	23	21				117.75	3.80			
Kuala Lipis, Pahang	84.1	70.9	77.5	88	66	78	73	81.0	82.5	81.0	82.5	1.26	10.55	268.0	28	27	1	17		106.60	3.44			
Kuala Pahang, Pahang	82.5	75.2	78.9	85	72	81	78	80.4	82.7	80.4	82.7	3.74	12.48	317.0	27	22				143.75	4.64			
Mount Faber, Singapore	85.2	72.5	78.9	90	71	76	74	79.9	81.7	79.9	81.7	2.29	11.02	279.9	22	18	1			146.10	4.71	39		
Butterworth, Province Wellesley	87.9	73.1	80.5	91	71	82	76	83.8	84.6	83.8	84.6	1.18	4.23	107.5	13	11				223.45	72.1			
Bukit China, Malacca	85.3	73.0	79.1	88	70	80	75	80.2	82.2	80.2	82.2	4.98	6.46	164.1	13	11				159.40	5.14	43		
Kluang, Johore	83.3	72.2	77.7	88	69	75	74	79.2	80.9	79.2	80.9	2.32	13.61	345.7	22	20	1	3		121.80	3.93	33		
Bukit Lalang, Mersing, Johore	81.1	74.0	77.5	84	71	78	76	78.9	79.7	78.9	79.7	2.02	12.01	305.1	24	20				123.75	3.99	33		
Alor Star, Kedah	88.6	71.3	79.9	91	68	82	74	82.0	84.0	82.0	84.0	1.52	2.65	67.3	8	5	1			239.40	7.72	65		
Kota Bharu, Kelantan	83.2	73.5	78.3	85	70	81	76	80.4	82.2	80.4	82.2	1.02	6.12	155.5	26	17				167.25	5.39			
Kuala Trengganu, Trengganu	82.2	73.6	77.9	84	70	79	77	79.4	80.8	79.4	80.8	1.20	5.22	132.6	25	21	2			150.40	4.85	11.9		
HILL STATIONS.																								
Fraser's Hill, Pahang 4268 ft.	67.0	60.4	63.7	71	58	63	62	69.1	70.0	69.1	70.0	2.43	18.35	466.1	27	26	1	26		57.05	1.84			
Pahang Cameron Highlands, Tanah Rata, Pahang 4750 ft.	69.4	59.7	64.5	73	55	65	62	68.1	68.6	68.1	68.6	1.63	6.04	153.4	23	19				140.00	3.35			
Cameron Highlands, Rhododendron Hill, Pahang 5120 ft.	68.1	58.3	63.2	73	55	63	60					1.67	6.28	159.5	25	20		5		111.30	3.59			

Compiled from Returns supplied by the Meteorological Branch, Malaya.

THE Malayan Agricultural Journal.

APRIL, 1933.

EDITORIAL

The Dwarf Coconut Palm.

In the year 1919 Mr. W. P. Handover contributed an article to the Agricultural Bulletin F.M.S. (Vol. vii., No. 5) on the dwarf coconut palm (*nyior gading*). In the article he stated that this type of palm probably first originated as a "sport" or mutant in Java and was later introduced into this country. In the year 1912 dwarf palms were first planted under estate conditions in Negri Sembilan where an area of 500 acres was planted from seed nuts obtained from dwarf palms grown by Malays on the rice fields of the Krian district. Considerable interest in the cultivation of this type of palm was aroused and a number of coconut estates planted up areas with dwarf palms in subsequent years.

Two Articles have been published in the Malayan Agricultural Journal (Vol. x., 1922, and Vol. xvii., 1929) giving information regarding the three varieties of dwarf coconuts grown in this country. It was shewn that the palms—particularly the "green" variety—gave good returns provided that the growth conditions were favourable and that the palms were given fair treatment.

In this issue of the Journal an account is given of further investigations carried out on estates and on the Government Coconut Experiment Station, Klang, on the growth and yield of dwarf palms and on the quality of the copra they produce. The account indicates that these palms appear to be very sensitive to unfavourable conditions resulting in poor growth and a falling off in yield, and also that the cost of production of the copra is somewhat higher than in the case of tall palms. Furthermore it is mentioned that, even if special care is taken in the manufacture of copra from dwarf palms, none of the varieties yield a product equal in quality to that obtainable from tall palms growing under similar conditions.

This information reveals certain drawbacks which tend to counter-balance the main advantage offered by dwarf palms of giving a return after five years compared with a period of eight years in the case of tall palms.

Lowland Tea in Malaya.

The article by J. N. Milsum, Acting Agriculturist and T. D. Marsh, Assistant Agriculturist, which is included in the present number under the title of "Lowland Tea in

"Malaya", records the result of experiments in cultivation and manufacture of black tea on 36 acres of land on the Government Experimental Plantation, Serdang.

The area under this crop is situated on soil of average fertility at an elevation of 175 feet above sea level, and the results achieved demonstrate the fact that lowland tea can be grown successfully and high yields be obtained in this country. Black tea has been manufactured at the Serdang factory for the past two years and has found a ready local sale.

Samples of the product have been submitted to firms in London and Ceylon who have reported satisfactorily upon them.

The figures of imports of tea into Malaya from different countries during the year 1931 are illuminating in that they show that the quantity of China tea as compared with black tea is in the ratio of approximately 2.5 to 1.

The import statistics for 1932 so far available indicate that as a rough approximation, based on the assumption that the ratio of imports of China and black tea were the same as in 1931, production from 6,500 acres of China tea and 2,000 acres of black tea would satisfy local consumption.

At the end of 1932 the area under tea in Malaya amounted to 2,645 acres, of which 1,996 acres were planted in the lowlands and 649 acres at high elevations. It will be seen, therefore, that although room for expansion of black tea production for the local market is limited, there remains a comparatively wide opening for the cultivation of tea which will fulfil the requirements of the Chinese population.

The production of China and green tea is now receiving attention at the Government Experimental Plantation, Serdang, but so far only limited results have been obtained. It is evident that further investigation on this subject will be of great value.

As regards the development of export of tea, enquiries have recently been received from Australia into the possibilities of the importing of Malayan lowland tea: these possibilities are now being investigated.

Packing and Transport of Palm Oil. The high cost of packing and transport of Palm oil has hitherto formed a serious handicap to the industry in Malaya. With the market price standing at the low figure of about £14 per ton, the difference between the cost of production and the market price is so small that the factor of transport is a matter of vital importance. Whereas for some years past this product has been shipped from Africa and Sumatra in specially constructed tank vessels, Malayan palm oil has, until recently, been exported in barrels, the materials for which were imported from America.

It is estimated that in the year 1931 the cost of barrels amounted to approximately \$200,000.

Efforts to manufacture barrels from local timbers have met with some

measure of success but since the annual production of Malayan palm oil now amounts to over 7,000 tons, the provision of measures for bulk shipments are justified.

The principal difficulty attached to the transport of this commodity in bulk has been its transference from the estate to the port of shipment. The provision of tank waggons which has already been made on the F.M.S. Railways and the construction of a tank lighter, which will shortly be completed by a local shipping firm for the conveyance of palm oil from estates situated on or near the Selangor and Bernam rivers, will do much towards solving the transport problems of this industry.

**Publications of the
Empire Marketing
Board.**

It is considered desirable that attention should be drawn to the publications which are issued periodically by the Empire Marketing Board. These monographs, of which 61 have been published on general agricultural and allied subjects, 23 on production and trade of the Dominions and Colonies, and 5 as a series of commodity reports, are of great value in the dissemination of results of up to date agricultural and statistical research within the Empire.

An abstract of the Empire Marketing Board's handbook No. 61 entitled "Survey of Oilseeds and Vegetable Oils" Volume II "Coconut Palm Products" was included in the March number of this Journal, while among others which may be recommended as being of special interest in this country are E.M.B.1 "Agricultural Economics in the Empire": E.M.B.2 "Tropical Agricultural Research in the Empire": E.M.B.54 "Survey of Vegetable Oilseeds and Oils" Vol. I "Oil Palm Products": E.M.B./T.P.23 "The Production and Trade of British Malaya" and E.M.B./C.4 and C.5, Commodity Reports on "Oilseeds and Vegetable Oils"* and "Plantation Crops"† respectively.

The above publications are obtainable from the Sales Office of His Majesty's Stationery Office, Kingsway, London, at prices ranging from 3d. to 2/6s. including postage.

**Departmental
Circulars.**

Attention is invited to the recently published circulars of the Department of Agriculture, S.S. and F.M.S., nos. 3 of 1932 and 4 of 1933 upon the subject of "The Cultivation of Allotments by Tamil Labourers" (also published in the Tamil language) and "Wet Rice Cultivation". These circulars are primarily designed to assist in estate managers and others improving the conditions of the growing of food crops by labour forces, and are available from either the Department of Agriculture, Kuala Lumpur, or from the Labour Office, Kuala Lumpur.

* This publication was reviewed in the *Malayan Agricultural Journal*, Vol. XXI, No. 2 of February 1933.

† Reviewed in the *Malayan Agricultural Journal*, Vol. XXI, No. 3, March 1933.

Original Articles.

LOWLAND TEA IN MALAYA.

BY

J. N. MILSUM,

Acting Agriculturist

and

T. D. MARSH,

Assistant Agriculturist.

Introductory.

It is proposed in the following article to record the results obtained with the cultivation and manufacture of tea at the Government Experimental Plantation, Serdang, and to review the prospects of lowland tea production in Malaya. With regard to manufacture, efforts have been so far directed mainly to the production of black tea. As will be shown later, however, the greatest opportunity for extension of the local tea industry appears to lie in the manufacture of China and unfermented teas.

The original planting programme at Serdang set aside an area of 15 acres for tea. The first consignment of tea seed was received from India during December, 1924. Details of early experiments with this crop have already been made public in Departmental publications (1) and (2).

Whilst it is known that tea is a sub-tropical plant and is best suited for cultivation at high elevations in the tropics, yet experience proves that black tea of very satisfactory quality may be produced on the plains in this country. A fairly wide range of imported Indian "jats" (varieties) together with seed from estates in Ceylon and a Chinese variety, have all made consistently good growth and yielded satisfactorily under local conditions.

It is of course generally known, that at the present time there is considerable over-production of tea compared with the existing world demands, and a scheme, designed to restrict production in certain countries, is under discussion. On the other hand the consumption of tea locally is considerable, and, with a return to more normal conditions of prosperity, it will certainly increase. Furthermore, it is to be noted that recently duties have been placed on tea imported into the Federated Malay States and other States in Malaya.

It is considered unnecessary to deal with the general principles of tea cultivation and manufacture since information on this subject was published recently by the Department of Agriculture in the form of a Special Bulletin (3). An article on the cultivation and manufacture of tea in mid-country districts in Ceylon was also published (4).

Imports.

Imports of tea into Malaya for the period 1929—1932, compiled from official returns, are shown in the following table:—

TABLE I.**Net imports of Tea into Malaya period 1929 - 1932.**

Year.	Quantity. lbs.	Value. \$
1929	10,152,422	3,885,275
1930	8,732,453	2,872,220
1931	6,848,642	1,667,931
1932	4,445,213	1,016,492

Import Duties.—The following duties on tea imported into the Federated Malay States have been imposed by the Federated Malay States Government, see Notification No. 8043 of 28th October, 1932:—F.M.S. Government Gazette,
Tea, per pound, full duty 8 cents,
preferential duty, 6 cents.

The following table shows the quantities of tea imported into Malaya from different countries during the year 1931:—

TABLE II.

Countries of origin.	Quantity of tea imported. lbs.	Total value. \$	Average value per lb. cts.
China ...	5,051,601	1,065,149	21
Ceylon ...	1,036,779	513,441	50
Java ...	757,723	142,484	19
British India ...	285,479	119,224	42
Hong Kong ...	196,486	40,662	21
Japan ...	107,833	22,924	21
Sumatra ...	65,549	12,558	19
United Kingdom ...	6,934	6,093	88
Siam ...	5,712	1,415	25
Burma ...	850	187	22
Sarawak ...	750	450	60
B.N. Borneo ...	320	60	19
Philippine Islands and Subu ...	35	60	171

The above Table is included since it records in detail the countries of origin of the tea imported into Malaya. Import figures for the year 1932 which have but recently become available show a considerable reduction as compared with these figures—c.f. Table I.

It will be seen from Table II that the imports of China tea as compared with black tea are in the ratio of approximately $2\frac{1}{2}$ to 1. The figures indicate that the product from some 10,000 and 3,000 acres respectively would meet the consumption requirements of Malaya for green and black tea for the year 1931. It is not possible as yet to compute the acreages necessary to satisfy present consumption requirements, as indicated by the imports for 1932, but it is estimated that the acreages mentioned above might, however, be reduced by one-third.

Unless, therefore, it is proposed to produce tea suitable for the Chinese population, there is little room for further planting of tea other than for export. Thus it may be stated, that whilst expansion of black tea production for local use is limited, there remains a comparatively wide opening for the cultivation of Chinese tea or unfermented tea agreeable to a large proportion of the Asiatic population.

Area Under Cultivation.

In Table III, the total acreage of tea planted in Malaya up to the end of 1932 is shown.

TABLE III.
Acreage of Tea under Cultivation in Malaya, 1932.

State or Territory.	Area in acres.
Perak ...	115
Selangor ...	809
Negri Sembilan ...	16
Pahang ...	703 (x)
Total F.M.S. ...	1,643
Malacca ...	15
Dindings ...	1
Total S.S. ...	16
Kedah ...	986
Total U.M.S. ...	986
Total Malaya ...	2,645

(x) 649 acres of which is upland tea.

Cultivation at the Government Experimental Plantation, Serdang.

Planting operations commenced in 1925, when some five acres were established. At the close of 1932, a total of 36 acres was planted, including 23 acres in bearing.

The following is a complete list of the "jats" planted:—

Jat.	Type.	Remarks.
Dangri	Manipuri	A large dark-leaved jat originally from the Manipuri Hills.
Dhonjan	Assam	A large dark-leaved indigenous Assam jat.
Rajghur	Hybrid	A vigorous hybrid between Assam and Manipuri jats.
Betjan	Assam	A large light-leaved indigenous Assam jat.
Markong	Manipuri	A large dark-leaved Manipuri jat.
Taikong	Assam	A pure indigenous dark-leaved Assam jat.
Kirrimittia	Manipuri	A dark-leaved Manipuri jat from Ceylon.
Bogawantalawa	Assam	A light-leaved Assam jat from Ceylon.
Mahawella	Manipuri	A dark-leaved Manipuri jat from Ceylon.
China	China	Seed obtained locally from Chinese holdings.

Climate.—The rainfall at Serdang shows the seasonal variation common to most of the interior of the Malay Peninsula with wet seasons during March—April and part of May and also October—December. A fairly long dry season occurs from the middle of June to the middle of September and a shorter dry season in January and February. Consequently the best months for planting are March—April and October—November. Flushing of new growth from the bushes is vigorous almost all the year, necessitating a seven-day plucking round,

except during the month of August, when an 8 to 9 day interval between plucking is found sufficient.

Soils.—The soils of the tea areas at the Experimental Plantation, Serdang, are composed of dark sandy to yellowish clay-loam belonging to the quartzite type, commonly met with in inland districts of Selangor. A full description of the soil is contained in the Guide to the Government Experimental Plantation, Serdang (2). The mean elevation of the plantation is approximately 175 feet above sea-level.

Nurseries.—In raising tea seedlings, two factors have been found essential under local conditions namely shade and a free rooting medium. Seeds may be either sown in sand beds under shade and transplanted, or sown in well cultivated beds dug to a depth of 18 inches and shaded with ataps. The best germination results have been obtained from sand beds. Up to the present propagation has been entirely from seed. Recently encouraging results have been obtained at Serdang from etiolated shoots, but no experience is so far available to show whether such rooted shoots would give satisfactory results in the field.

Planting.—The “jats” Dangri, Dhonjan, Rajghur and Betjan planted 4 feet by 4 feet square, in Block 3, indicate that the planting distance might be somewhat closer. The bushes, pruned at intervals of two years, do not actually meet in the rows, except in the ravines where the soil is above average fertility. To obtain more exact information on this point, a planting distance experiment with Dangri “jat”, planted in May, 1929, in Block 16 is under observation. The area of the block is 9 acres and this is divided into three 3-acre plots with the following planting distances :—

<i>Plot.</i>	<i>Planting Distance.</i>	<i>Bushes per acre.</i>
1	4 feet x 4 feet.	2,720
2	4 feet x 3½ feet.	3,111
3	4 feet x 3 feet.	3,630.

Plucking commenced in May, 1932, *i.e.* three years after planting. It will be sometime, however, before definite results will be forthcoming from this experiment.

With regard to planting, it has been found that good sized stumps up to two years old, are far easier to establish than seedlings of younger ages. Furthermore, the care required in handling and planting is considerably less with stumps than with younger seedlings. Old stumps, devoid of soil, root readily, whilst young seedlings, even with a ball of soil round their roots, fail to become established in a large number of instances.

Leguminous Shade Trees.—The most successful shade tree that has been tried at Serdang is *Albizzia moluccana*; this gives the ideal high feathery shade so desirable for lowland tea. This tree has attained a height of 50 feet in three years from planting, the nursery seedlings being about three months old when transplanted. The trees should be widely spaced, a final stand of 80 feet by 40 feet apart is suitable; if planted closer a considerable amount of thinning out becomes necessary. *Albizzia moluccana*, has however, two defects. The wood



FIGURE 1

Manipuri Tea Seedlings, one year old at Government Plantation, Serdang.



FIGURE 2

Manipuri Tea, four years old, recently pruned, on same area as in Fig. 1, showing rapid growth of *Albizzia moluccana*.

is soft and in exposed situations the branches and often the trunk are liable to be broken by high winds. This defect can, to some extent, be minimised by planting a belt of suitable trees to act as wind breaks. For this purpose *Grevillea robusta* has proved fairly satisfactory, although growth is not so vigorous on the plains as at higher elevations. Another defect is that *Albizzia moluccana* is liable to suffer from considerable defoliation by caterpillars of a small yellow butterfly (*Terias hecabe*), during certain periods of the year. An outbreak occurred at Serdang towards the end of 1932, when migration of the caterpillars from the *Albizzia* to tea bushes in the near vicinity resulted in the latter being seriously attacked.

Two other species of *Albizzia* namely *A. fastigata* and *A. stipulata* are under trial but have proved unsatisfactory.

Gliricidia maculata, although a considerably smaller tree than the former, has proved a satisfactory shade tree and green manure. It is particularly suitable for exposed situations. The usual planting distance is about 15 to 20 feet apart. A large amount of green foliage is produced and, when periodically pruned, provides a valuable supply of green matter for the soil. It does not, however, give the high feathery shade as does *Albizzia moluccana*. *Gliricidia* is readily propagated from stem cuttings which should be 10 feet long and one inch in diameter.

Erythrina lithosperma, "dadap", which is commonly used as a green manure tree on mid-country estates in Ceylon, is almost invariably attacked under Serdang conditions by a large borer caterpillar (*Tetrastria meticulosalis*). From results shown to date it is not recommended to plant this tree extensively. It might, however, prove more successful on better land where vigorous growth would combat the damage done by borer caterpillars.

Cover Crops and Green Manures.—The most satisfactory of the taller leguminous plants under trial have proved to be *Crotalaria anagyroides*, *C. usaramocensis*, and *Tephrosia candida*. These plants make excellent auxiliary shade for young tea, if allowed to grow tall: they may be pruned periodically. By this means the surface soil is kept cool and erosion is prevented. A tea estate on virgin land on the lowlands in Malaya has been maintained in a clean condition and brought to the plucking stage at a very low cost by the intensive use of *Crotalaria anagyroides*.

After the tea bushes are pruned preparatory to plucking, the green manures should be periodically cut back to a height of about two feet and the prunings returned to the land. It is, of course, too costly an operation to bury all such prunings in the soil, since the plants require pruning at intervals of three months or so. The only practical method is to spread the prunings on the surface and gradually incorporate them with the soil during weeding operations.

Experiments designed to ascertain the quantities of green matter produced from typical leguminous plants have been carried out at the Experimental Plantation, Serdang, with the results shown below. The green manures were sown between every second row of tea.

Prunings from Green Manures.

Green Manures.	Period between prunings.	Wt. of green matter per acre per annum. lbs.	Calculated dry matter. lbs.
<i>Crotalaria anagyroides</i>	2 months	18,870	4,715
<i>Crotalaria usaramocensis</i>	2 months	11,350	2,837

The life of the green manure plants is only $2\frac{1}{2}$ to 4 years under ordinary conditions and unless natural seeding takes place or resowing is undertaken, other forms of soil conservation become necessary. This has been accomplished by the use of low-growing leguminous cover plants. The most successful cover crop tried at Serdang is *Indigofera endecaphylla*. This plant forms a low-growing matted cover over the ground and, what is more important, it does not climb into the tea bushes. Another plant that shows promising results is *Desmodium heterophyllum*.

When the tea bushes have become sufficiently large to cover the land the use of cover plants becomes less necessary, especially where loss of surface soil from erosion is not excessive. To establish a good stand of cover plants or green manures, the practice at Serdang is to mix a small quantity of a basic phosphatic fertiliser with the seed and sow seed and fertiliser together. Basic slag mixed with the seed at the rate of $\frac{1}{2}$ cwt. per acre is employed. The mixture of seed and fertiliser is sown in drills between each row of tea in the case of low covers, and between alternate rows when establishing tall-growing green manures.

Soil Conservation.—A considerable number of experiments are in progress at the Government Plantation, Serdang, with a view to obtaining information regarding this important subject. Whilst on the highlands of Malaya severe damage from soil erosion in tea areas has not been found to occur, the reverse is the case in the lowlands. It is important, therefore, that adequate preventive measures against soil erosion should be taken from the commencement of opening the land. As already mentioned, an excellent preventive against soil erosion in the early stages of growth is the employment of tall-growing leguminous plants which protect the soil from downpours of rain. The most satisfactory measure against soil erosion has been found to consist of a combination of contour silt pits, with a leguminous plant or strong-rooting grass, planted upon the bund in the form of a hedge. For this purpose *Crotalaria anagyroides*, *Clitoria cajanifolia* and Vetiver grass, *Vetiveria odorata*, have been successfully employed.

On moderately undulating land contour silt pits, 30 feet long by 2 feet deep and 2 feet wide, with stops two feet wide between the ends of the pits, have

been used with success. The distance between each row of contour pits should average half a chain. Vetiver grass has a vigorous root system which conserves the bunds. It is necessary to plant the root cuttings closely, not more than 4 inches apart. The grass is cut back periodically and the green matter returned to the land. *Clitoria cajanifolia* may be used in a similar manner and since it is a deep rooting legume it forms an excellent hedge plant on hill sides. On steep land contour terracing has been undertaken at the Experimental Plantation, Serdang, on a small area in Block 3 for the purpose of comparing the relative merits of these two systems of soil conservation. There does not appear to be any necessity for terracing unless the land is very steep. *Tephrosia candida* and Vetiver grass are planted on the edges of the terraces to assist in holding up the soil. The cost of terracing land for tea is comparatively expensive and for this reason is not recommended unless other forms of soil conservation are considered ineffective.

Manuring.—With a crop such as tea, where a large amount of the plants' growth is removed at short intervals, it is obvious that frequent manuring is necessary and such has proved to be the case at the Experimental Plantation, Serdang. Up to the present, the somewhat complicated and expensive manurial mixtures outlined below have been employed.

Block 3. Pruning Mixture.—This area was planted in 1925 on virgin land, it was first manured after pruning in October, 1930. The following mixture was applied by the process of "envelope" forking:—

150 lbs.	Whale guano compound
50 "	Sulphate of ammonia
50 "	Nitrate of soda
150 "	Superphosphate
50 "	Sulphate of potash

450 lbs. per acre.

The growth and yields during the past two years have been excellent and the bushes have undoubtedly derived great benefit from the application of fertilisers.

Block 15 and 16, planted during 1929, on land that had grown crops previously, showed slow growth and received a new clearing mixture as detailed below:—

Block 15 and 16. New Clearing Mixture.—

50 lbs.	Whale guano compound
50 "	Sulphate of ammonia
150 "	Superphosphate
50 "	Sulphate of potash

300 lbs. per acre.

For the purpose of obtaining information as to the relative values of organic and inorganic fertilisers the following manurial experiment has been laid down on a small area of tea in Block 15, planted November, 1929.

The fertilisers applied comprise:—

- (a) An acid mixture
- (b) A basic mixture
- (c) General organic mixture
- (d) Control (no manure).

It is proposed to extend this experiment over a larger area when preliminary results have been obtained.

Pruning.—Lowland tea in Malaya arrives at the plucking stage in about three years after planting in the field. This period varies somewhat according to (a) the size and age of planted stumps (b) fertility of the soil, (c) treatment of bushes from planting to plucking. The tea bush is best able to withstand the severe shock of pruning when growth is active and starch reserves are high. The starch content of the bushes is raised by cessation of plucking for a few weeks before pruning. The most satisfactory time for pruning has proved to be the latter part of October and all pruning at Serdang is now undertaken during this month. Pruning of the tea bush is an important undertaking and fully satisfactory results can only be obtained with practice and experience. The general principles of tea pruning are described in the Special Bulletin on tea cultivation (3) pages 28—35.

Experience at Serdang demonstrates that when tea is planted on land that has grown a previous crop and become impoverished, considerable damage may result from the attacks of termites. The cause of these attacks is due to the pruned branches dying back owing to lack of vigour of the bushes, thus affording entry to the termites. By planting on virgin land and maintaining vigorous growth of the bushes by manuring, little or no damage from termites is likely to occur. Control measured against termite attack of tea bushes on impoverished land at Serdang are now being investigated by the Government Entomologist.

Plucking.—It has been found at Serdang that a weekly round of plucking is satisfactory for about eleven months of the year, the month of August with the lowest rainfall, requiring an interval of eight or nine days between the plucking rounds. This operation requires a considerable amount of supervision at the start to ensure satisfactory results from the inexperienced labour usually available.

The system of plucking undertaken may be termed "fine" since two leaves and the bud only are plucked. Soft "banji" is included in the leaf for manufacture; hard "banji" is plucked and discarded. It should perhaps be mentioned that the leaves are of two distinct types—ordinary and "banji"; the latter is a leaf with a stunted bud which generally makes no further growth.

China tea.—The statistics quoted at the commencement of this article show the large amount of China tea imported into Malaya. The production of tea of this type and of green tea is receiving attention at the Government Plantation,

Serdang, but so far only preliminary results have been obtained. It is evident that the production of teas suited to the requirements of the Chinese population warrants extended investigation.

It should be mentioned here that the manufacture of green tea as distinguished from black, differs in that the former does not undergo any process of fermentation, while the comparatively slow operation of withering is replaced by the rapid one of steaming. Certain teas known as "oolong" teas are manufactured by a process halfway between that of green and black tea. The leaf is slightly withered and lightly fermented before the tea is dried.

With regard to yields the one-acre plot of China tea planted in Block 3 during November, 1926, gave a crop of 480 lbs. of made tea for the full cropping year ending October, 1932.

Some China tea is grown on the lowlands in Malaya, particularly in the Cheras district of Selangor. A description of these areas and the methods employed in the cultivation and manufacture by Chinese has already been published (5).

Yields.—In Table IV the yields of leaf and calculated yields of made tea from four one-acre plots of mature tea in Block 3 are recorded. This area was planted early in 1925 and reached the plucking stage on the 12th October, 1928. Plucking has been carried out continuously since that date with the exception of a three month's rest after pruning which was undertaken in October, 1930. All vacancies have been supplied and a proportion of these supplies have now been brought into the plucking round.

Yields from Blocks 15 and 16 where plucking commenced in May, 1932, are being recorded but are as yet of insufficient value to be worth publishing.

Insufficient evidence is as yet available to enable a pronouncement to be made as to which "jats" are the most suitable for cultivation on the lowlands of Malaya. All four "jats" referred to in Table IV have made good growth, flushed well, and given satisfactory yields.

Manufacture.

The following description of manufacture refers solely to black tea which has so far only been produced for sale at Serdang. The reports on samples submitted to London and Colombo also refer to black tea.

Tea Factory at the Experimental Plantation, Serdang.

The tea factory commenced operation during July, 1931. It is a permanent type of building, based on a modern Ceylon design, 60 feet long and 40 feet wide. Rolling, fermenting, firing and sifting rooms are on the ground floor and a withering loft above.

The withering loft contains five series of "tats" each complete "tat" being 33 feet long by 7½ feet wide, with seventeen layers of hessian cloth, providing

TABLE IV.

Yields of Leaf and Made Tea from 12th October, 1928 to 11th October, 1932.

Jat.	Period.	No. of bushes plucked.	Percentage actual to possible bushes.	Weight of leaf plucked lbs.	Yield of Tea per plot. lbs.	Remarks.
Dangri	Oct. 28 — Oct. 29	2,249	82.6	2,452	613	9 months plucking.
	29 — 30	2,229	81.8	2,815	714	
	30 — 31	2,102	77.2	2,169	542	
	31 — 32	2,395	88.0	4,340	1,085	
Dhonjan	28 — 29	1,749	64.4	2,079	520	9 months plucking.
	29 — 30	1,740	63.9	2,616	654	
	30 — 31	1,826	67.1	1,829	457	
	31 — 32	1,983	72.9	4,056	1,014	
Rajghur	28 — 29	2,198	80.7	1,792	448	9 months plucking.
	29 — 30	2,190	80.5	2,413	603	
	30 — 31	2,170	79.7	2,003	500	
	31 — 32	2,005	70.7	3,851	963	
Betjan	28 — 29	1,313	49.7	1,870	467	9 months plucking.
	29 — 30	1,300	47.8	2,303	575	
	30 — 31	1,856	68.2	1,850	462	
	31 — 32	2,071	76.1	3,733	944	



FIGURE 3

Young Tea on terraced land with hedges of *Tephrosia candida*.



FIGURE 4

Tea Factory at Government Plantation, Serdang.

a total withering space of 21,037 square feet, capable of holding 1,500 to 2,000 lbs. of green leaf per wither according to density of spread. Two 36 inch exhaust fans are installed in the withering loft. At the opposite end of the loft is an air bulking chamber which extends to the full width of the building. Hot air is drawn from the tea dryer and expelled into the loft, when artificial withering is necessary, by controllable vertical palisades which give any degree of opening desired.

The machinery installed comprises the following. Two "Little Giant" tea rollers, each having a capacity of 60 lbs. of withered leaf per charge. An improved tea roll-breaker fitted with beating apparatus and sieves. A 42 inch "Venetian" tea drying machine with a firing capacity of 45 to 50 lbs. of made tea per hour. The sifter installed is of an improved pattern, with three trays, 7 feet long, the brass wire sieves of which are 8, 10, 12 and 24 wires to the linear inch. There is also a 24 inch exhaust fan operated near the tea sifter, and a single cylinder tea cutter fitted with $\frac{3}{4}$ inch cells. The machinery is driven by a 13 B.H.P. electric motor, working at 580 revolutions per minute.

Withering.—The leaf from the field is sorted and all hard "banji", stalk and over matured leaf is discarded. This is done to reduce the quantity of red leaf, stalk and fibre in the finished product.

The leaf is spread on the "tats" at the rate of 1 pound to 10 to 14 square feet of hessian. The rate of spreading is varied according to the atmospheric humidity, when it is high the larger area on the "tat" is used, so that a natural wither can be obtained within the reasonable time of 18 to 24 hours. Hygrometers are used to indicate the humidity of the atmosphere and when readings are recorded showing a difference between the wet and dry bulbs of 4 degrees or less, artificial withering is employed. Artificial withering consists of the use of hot air mixed with atmospheric air so that the relative humidity of the mixed air is lowered and thus becomes capable of taking up moisture from the withering leaf. The leaf is withered until it is reduced in weight by loss of moisture to 55—60 per cent. of that of the fresh leaf. In practice, appearance and smell serve as a guide to correct withering.

Rolling.—The speed of the two "Little Giant" rollers is from 55 to 58 revolutions per minute, each roller taking 60 lbs. of withered leaf per charge. The rolling programme for general use is as follows:—

First rolling 30 minutes, no pressure.

Second rolling 45 minutes, light pressure (the weight is applied for 5 minutes and off for 5 minutes).

Third rolling 45 minutes, more pressure than the second rolling (the weight is applied for 5 minutes and off for 5 minutes).

Fourth rolling 30 minutes, more pressure than the third (the weight is applied for 5 minutes and off for 5 minutes).

Fermentation.—The leaf tips or "dhool" that pass through the sieve of the roll-breaker after each period of rolling are allowed to ferment in separate lots for a period of about 2½ hours. Later "dhool" and the final bulk require a shorter period of fermentation. The operation is carried out on two tiered

tables, constructed on an iron framework, with smooth concrete fermenting surface. The fermenting leaf is placed on the tables to a standard depth of $1\frac{1}{2}$ inches. Coolness and high atmospheric humidity are provided during fermentation by means of an air current over dripping water.

Firing.—The tea at Serdang is dried at a maximum temperature varying between 195°F and 200°F , at the air inlet, the exhaust temperature of the air varying between 120°F and 130°F . These temperatures are controlled by (1) the rate of stoking, (2) the damper at the foot of the Tea Dryer, and (3) the speed of the exhaust fan. The time taken to pass the “dhool” through the dryer is 30 minutes, the bulk tea requiring a little longer. The capacity of the “Venetian” Tea Dryer installed is about 40 lbs. of made tea per hour.

Grading.—The “dhool” and bulk tea are graded on the sifter in the ordinary way. The following are lists of the various grades of tea manufactured at Serdang :

- (a) average percentage grades for period June—December, 1932.
(b) maximum recovery of higher grades.

	(a)	(b)
Broken Orange Pekoe ...	38.94 per cent.	51.85 per cent.
Broken Pekoe ...	17.17 „	9.72 „
Pekoe ...	20.83 „	23.15 „
Fannings ...	16.06 „	10.65 „
Dust ...	7.00 „	4.63 „
	100.00 per cent.	100.00 per cent.

Marketing.—All tea manufactured at Serdang has been sold locally up to the present. The tea is marketed in soldered and sealed lead packets with a covering label. It is found that $2\frac{1}{2}$ ounce lead sheets are sufficiently strong for packets weighing not more than one pound. The tea is despatched to the distributors in paper-lined wooden cases, each containing 50 lbs. of tea, made to accommodate either $\frac{1}{4}$, $\frac{1}{2}$ or 1 lb. packets.

The tea manufactured has been sold in packets to the distributing agents at the following wholesale prices :—

Broken Orange Pekoe ...	60 cts. per lb.
Orange Pekoe ...	50 cts. „
Fannings ...	40 cts. „
Dust ...	25 cts. „

These teas have been retailed throughout Malaya during 1932 at 10 to 15 cts. above the wholesale prices. In spite of the import tax, prices of imported tea have fallen recently and the above prices have now been lowered to meet competition from outside sources.

Reports and Valuations.

The reports on two samples of tea grown and manufactured at the Experi-

mental Plantation, Serdang are given below. It will be seen that the tea is favourably commented upon, although there is some room for improvement.

The third report is on a sample of tea grown on an estate in the lowlands and manufactured at Serdang. The sample represents the first plucking from young bushes.

The Department of Agriculture is always ready to undertake the manufacture of small breaks of tea from local estates for the purpose of obtaining early reports upon their quality and valuation.

(1) Report by Messrs. Shepard & Co., London, dated 12-10-31.

Leaf—Leaf is a well made but rather mixed Orange Pekoe with a little tip. Contains some small leaf but we should say might be suitable for continental trade.

Infused leaf—is a good even colour.

Liquor—Liquor has good strength and colour and “creams,” fairly well. It is rather lacking in point and flavour. We value this tea about 1/0d. per lb. on to-day's (12th October, 1931) London market.

The general style of manufacture is distinctly good and the tea is somewhat similar in type to an ordinary Assam Orange Pekoe. The tea, however, is not of a kind to realize a big price on the London market. The leaf contains too much twist to be in demand for Home blenders while it is rather mixed from the export point of view. From the colour of infused leaf and cup character, however, we should say the tea has distinct possibilities.

If it were decided to sell in London it would be advisable to make the leaf smaller and more even, with a brisker liquor. We are sending two samples of Assam Broken Orange Pekoe and Broken Pekoe (two grades into which your tea could be sorted) now selling in London at good prices and which we think your tea would be capable of imitating.”

Corresponding prices in London were Assam 1/5½d. per lbs., Cachar and Sylhet 8½d. per lb.

Reports from London received this year (1933) value the Broken Orange Pekoe grade at 8½ pence to 1/- per lb., and 7—8 pence per lb. for the lower grades. One report made special mention of the quantity of tip present for low grown tea.

(2) Report by Messrs. Keell & Waldock, Colombo, dated 15-3-32.

<i>Grade.</i>	<i>Colombo</i>	<i>Remarks.</i>
	<i>Valuc.</i>	
B.O. Pekoe and	70 Nom.	Good size, black leaf, little
B.P. bulked		flaky, fair show of bright
		tip.

Liquor—fair strength and colour.

Infused leaf—fairly bright, little mixed.

The leaf is of useful size and colour and although a little flaky, has a good show of bright tip.

The liquor has fair strength and colour, but is rather lacking in quality. This, however, can hardly be expected from an elevation of 250 feet above sea-level."

(3) Report by Messrs. Cumberbatch & Co., Ltd., Colombo, dated 29-8-32.

"We are in receipt of your letter dated the 16th instant together with samples received under separate cover, and append below our remarks thereon for your information :—

B.O.P.	Useful size, little irregular, curly, black, good show of tip. Coloury, plain, little strength and quality. 45/48.
B.P.	Useful size, fairly even and open, greyish, few dull tips. Coloury, plain, little strength and quality. 24/26.
O.P.	Useful size, fair twist, little mixed, greyish, few dull tips. Light and plain, little strength and quality. 28/30.
Pekoe	Good size, even, choppy and open, greyish. Fair, colour, plain, little strength and quality. 24/26.
Fannings	Useful size, little mixed and open greyish, fair tips, few fibres. Good colour, plain, little strength and quality. 28/30.
Dust	Useful size, powdery, greyish, few fibres, little sand. Good colour, plain, little strength and quality. 18/20.

Costs of bringing Tea into bearing.

The following is an estimate of the cost of bringing a small lowland tea estate into bearing. It must be appreciated that although many of the items represent actual costs at the Experimental Plantation, Serdang, under estate conditions, management and other factors might result in a considerable variation in many details.

No allowance is made for cost of supervision, survey fees, recruiting and medical charges, or water supply. It is considered, however, that the costs recorded serve a twofold purpose since they provide a summary of the operations necessary in the opening and management of a young tea estate.

Estimated Costs of Bringing Lowland Tea into Bearing.

Costs per acre.

Preparation of Land.

Tools and Stores	...	\$10.00	
Rent and premium	...	7.50	
Felling, burning and clearing	...	8.00	
Stumping and levelling	...	45.00	
Contour pits and soil conservation	...	12.50	
Cover crops and green manures	...	7.00	\$90.00

Cost of Seed and Nurseries.

Cost and transport of Indian seed	...	80.00
Preparation of sand beds and planting seed	...	5.00
Watering and weeding	...	3.00
Preparation of nursery beds and attention	...	20.00
Removal of shade, lifting and transplanting stumps	...	10.00
Additional seed for supplies up to 3rd year	...	15.00

Lifting and transplanting supplies to field ...	10.00	\$143.00
<i>Planting.</i>		
Lining and pegs ...	10.00	
Holing ...	15.00	
Planting and shading ...	16.00	
Supplying $\frac{1}{3}$ area ...	15.00	
Supplying to 3rd year ...	10.00	
Shade trees, seed, nursery and planting ...	4.00	\$70.00
<i>Upkeep for Three Years.</i>		
Weeding at \$2 per month ...	72.00	
Upkeep covers and green manures at 50 cts. per month ...	18.00	
Lalang eradication at \$2 per annum ...	6.00	
Pruning and topping bushes ...	8.00	
Upkeep of contour pits at \$3 per annum ...	9.00	
Drainage at \$3 per annum ...	9.00	
Pruning mixture and application of fertilisers	16.00	
Removal of prunings and envelope forking ...	4.00	
Pruning shade trees, 2nd and 3rd years ...	2.00	\$144.00
<i>Factory Capital Charges.</i>		
Actual cost of factory capitalised on 150 acres		\$133.00
<i>Roads, Bridges, Bungalows, Coolie-lines and Stores.</i>		
Estimate ...		\$120.00
Cost per acre ...		<u>\$700.00</u>

To secure a proper appreciation of the costs recorded it should be borne in mind that a considerable proportion of the work undertaken is charged at approximately 20 per cent. higher labour costs than are now current. In addition the smallness of the area of tea grown at Serdang results in increased expenditure. Although tea planting is a comparatively expensive form of cultivation it is considered that at the present time small areas of lowland tea might be brought to the plucking stage for \$500 per acre, including cost of factory and machinery. On land opened from jungle where a leguminous plant such as *Crotalaria anagyroides* is established, weeding cost can at present be kept as low as 35 cents per acre per month.

Conclusions.

An attempt has been made at the Government Plantation, Serdang to cultivate and manufacture lowland tea. The results obtained are satisfactory, since black tea of good quality is produced which is readily saleable locally, and well reported upon both in London and Colombo. The yield of eight-year old tea at Serdang is shown to exceed 1,000 lbs. made tea per acre for a 12 months

plucking round. This yield is governed to a large extent by the system of plucking employed, which as far as circumstance permitted, has been kept "fine".

Opportunity for expansion of production of black tea for local consumption is distinctly limited. The possibility of a market for such tea in Australia might, however, well repay investigation. There is a comparatively large local demand for China tea and teas of partially or totally unfermented types agreeable to many Asiatics. This branch of tea production is receiving attention by the Department of Agriculture.

Acknowledgments.

The writers are indebted to Mr. B. Bunting, Agriculturist, S.S. and F.M.S. for his direction and interest in the work with tea at the Experimental Plantation, Serdang. Also to Mr. N. Kanagaratnam, Field Assistant, whose training and experience in Ceylon have been of considerable value, particularly in regard to factory practice.

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 - (4) Tea Cultivation and Manufacture in Ceylon, *Malayan Agricultural Journal*, Vol. XVIII, 1930, page 428.
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FURTHER OBSERVATIONS ON THE DWARF COCONUT PALM IN MALAYA.

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Introduction.

The yellow, the red and the green varieties of dwarf coconut palm were first fully described in this Journal by Jack and Sands* in 1922. Later, as a result of systematic observations over several years on five palms of each variety at Parit Buntar, the same authors† published a further statement and included therein some interesting statistics which they had compiled from the production records of six estates.

It was shewn that "given suitable conditions and fair treatment, the dwarf palm (particularly the green race) is a sound commercial proposition".

The Government Coconut Experiment Station.

A further development of the study of dwarf palms has occurred with the establishment of the Coconut Experiment Station at Klang, where between 1924 and 1929 a few acres were planted with dwarf palm seedlings which had been obtained from Parit Buntar and elsewhere.

The seedlings were planted triangularly allowing 100 palms per acre. The 1929 plantings derived from the palms studied at Parit Buntar are just coming into bearing while the older palms obtained from various sources and from palms of unknown yielding ability, which are now about 7 years old are giving average yields of 40 fruits per palm per annum for the green and yellow varieties, and 30 per palm for the red variety, which is equivalent to 11.4, 8.4 and 7.6 piculs per acre respectively calculated on the basis of the weights of copra per nut given in column 6 of Table IV.

The soil is a stiff alluvial clay, fairly well drained having transverse 2½ foot drains, at 60 foot intervals, leading into a 4 foot main lateral drain. Being low-lying the plantation was at one time liable to sea-water flooding at very

* *Malayan Agricultural Journal*, Volume X No. 1, 1922 "The Dwarf Coconut Palm in Malaya"

† *Malayan Agricultural Journal*, Volume XVII No. 6, 1929 "Observations on the Dwarf Coconut Palm in Malaya".

high tides. This adversely affected the growth of the palms and an improvement was noticeable soon after the installation of a "flap-trap" water gate in 1931 in the main drain outlet.

Drainage in wet weather, however, is not quite adequate but if the drains were deepened the palms might then suffer from drought in dry weather.

The growth of the palms is nevertheless satisfactory and the yields while fairly good, are lower than those of dwarfs growing under optimum conditions. The quality of the copra from both the dwarf and the tall palms on the Experiment Station is above average as may be seen from Table IV.

The Dwarf Palm under Estate Conditions.

Meanwhile plantings of dwarf palms under estate conditions have also taken place. The fact that dwarf palms could yield an economic crop after five years as compared with eight years for tall palms has been an attraction, especially where working capital was so limited that a speedy financial return was necessary; while added interest has been gained for this type of palm because of one instance in which the very fine crop of over 19 pikuls per acre per annum was recorded from seven year old palms. While, however, on a few estates the yield of copra per acre from dwarf palms is greater than that from mature tall palms, in other cases the palms have yielded so poorly that the crop is regarded as hardly worth harvesting although adjacent tall palms have given satisfactory yields.

This emphasises the warning given by Jack and Sands that "where conditions for growth are good, the dwarf palm gives excellent returns, but where conditions are only fair or rather difficult they are not so satisfactory". This warning was, perhaps, insufficiently emphatic in view of our present knowledge of the rapid deterioration of dwarf palms in poor soil conditions.

Information has been received within the past few months from estates with both tall and dwarf palm cultivation that, at least for the immediate future, only tall palms will be planted in new areas or as supplies, even though in two instances yields from dwarf palms are good.

A consideration in connection with the cultivation of dwarf palms which must not be lost sight of is the additional cost of preparing these nuts for manufacture. It has been computed that it costs the equivalent of 5 cents more per picul of copra to husk and split dwarf palm nuts than nuts from tall palms. If large yields of good copra are obtained from areas of dwarf palm, then this added cost is covered, but where yields from dwarf palms do not greatly exceed those obtainable from tall palms, this factor cannot be overlooked.

By far the most commonly planted and best known variety of dwarf palm and that from which the bulk of estate experience and production figures have been obtained is the "yellow" variety; this is largely due to the fact that previously, supplies of this type only were available in sufficient numbers: the green dwarf palm has only very recently been selected exclusively for planting on estates.

TABLE I.
Comparative Yields of Copra from Dwarf and Tall Coconut Palms on Four Important Estates in the Coastal Districts of Selangor & Perak.

Estate	Soil Conditions	Type of Palm	Planted	Yields of copra in pikuls per acre											
				1921	1922	1923	1924	1925	1926	1927	1928	1929	1930	1931	1932
A	Rather high-lying stiff alluvial clay, deeply drained and well-irrigated. Dwarf palms given extra irrigation since 1931.	Dwarfs	1921	—	—	—	—	—	4.00	4.73	19.29	16.88	21.60	18.88	22.60
		Talls	1914 onwards	3.85	6.11	5.87	5.30	5.10	6.12	7.71	6.64	7.76	10.72	10.40	9.55
B	Loamy alluvial clay, well drained and irrigated since 1915. Dwarf palms intensively irrigated since 1931.	Dwarfs	1921	—	—	—	—	—	5.40	7.03	14.33	8.94	14.88	14.93	15.18
		Talls	1905 onwards	14.00	13.25	12.65	12.65	13.07	14.12	12.14	12.88	13.31	12.35	12.81	14.20
C	Light, peaty alluvial clay, very well drained. Irrigated since 1931.	Dwarfs	1920	—	—	—	3.20	8.53	8.50	7.00	11.47	7.55	7.88	3.64	7.50
		Talls	1910	8.60	9.31	9.19	10.00	9.90	12.20	11.05	12.00	11.95	11.86	10.59	11.13
D	Low-lying stiff alluvial clay, in places sandy or peaty, with areas where sulphurous ooze may be seen in the drains. Well drained.	Dwarfs	1920 onwards	—	—	—	—	5.67	10.85	6.97	10.58	3.09	4.33	3.60	4.75
		Talls	1916 onwards	—	—	—	—	—	8.50	8.74	9.72	10.02	9.62	9.63	9.56

The Correct Environment for the Dwarf Palm.

It seems evident that dwarf palms will only give their remarkable yields of fruit and copra under certain specific conditions. They are more sensitive than tall palms to an environment that is less than optimum and will show quicker response to improvement or deterioration in conditions.

They appear to favour a soil stiffer than that which is most suitable for tall palms and require greater attention to drainage. Furthermore, they benefit greatly by irrigation and will give increased yields with any system which ensures perfect water movement through the soil. Under such conditions they appear to prefer a water table which is slightly higher than that which seems best for tall palms, (about $2\frac{1}{2}$ feet as opposed to $3\frac{1}{2}$ feet).

Low-lying, brackish, and sulphurous soils appear to offer to dwarf palms an even more unattractive environment than they do to tall palms, while deep peat in which the water level changes seasonably is also unsuitable as it may become seriously affected by drought.

Yields in excess of 22 piculs per acre per annum have been obtained from 12 year old dwarf palms on one estate. Here the soil is a very stiff alluvial clay, very well drained, and irrigated with fresh water. On another estate (estate C in Table I) the soil is a friable, peaty clay, and was so well drained that the water level was drawn away from the roots of the dwarf palms, resulting in a considerable falling off in crop due to a decrease in the size of nuts as well as in the number of nuts per palm.

Irrigation was adopted for the dwarf palms on this estate for the first time in 1931 and they have quickly shown an improvement in size and numbers, while the prospect for 1933 is a likelihood of further improvement.

The system of irrigation employed on these estates is, briefly as follows: alternate drains are filled with water, and the remainder forming a separate system are kept fully open or are maintained with a lower level of water, so that there exists a constant difference in water level between the two systems.

Another possible reason for decreased and poor yields from dwarf coconut palms is found in Estate D which is typical of much low-lying coastal land closer to the seashore than the other estates referred to in the Table. Here there is often found in the drains a sulphurous-smelling, dark, oily fluid, the product of inorganic matter decomposing under anaerobic conditions and often found in very young coastal alluvial areas.

Quality of Copra from Dwarf Palms

During the past four years, special attention has been given to the question of improved copra manufacture in Malaya, and in this connection the quality of the copra obtainable from dwarf palm coconuts has come under observation.

Jack and Sands have stated that copra derived from the yellow dwarf type was difficult to cure and that this type of dwarf greatly predominated in local plantations of "dwarfs". They also stated that "the price obtained by estates for copra derived from dwarf palms does not differ materially from that paid for copra from tall palms, in fact most estates do not even separate them in preparing consignments for sale." This latter statement shows that the local market was not a very discriminating one in 1927. Actually, even now, copra standards in Malaya are ill defined and although increasing quantities of improved copra are being produced, low grade copra, being available in large quantities, still rules the local market. For this reason ordinary estate-produced copra obtained from dwarf nuts, containing a moderate percentage of off-quality copra, could still be classified as sundried in the ordinary local market.

TABLE II.

Comparative Statement of Quality and Yield from Dwarf Coconut Palms, Predominantly of the Yellow Variety.

Estate	Soil	Water Movement	Yield of copra in p.p.a. 11th year	Number of nuts per picul of copra	Percentage of rubbery copra	Contemporary yield of copra from adjacent mature tall palms
A	Stiff, alluvial clay	Deeply drained and well irrigated	22.60	550	80	9.55
B	Loamy, alluvial clay	Well drained and well irrigated	15.18	550	70	14.20
C	Light, peaty, alluvial clay	Excessively drained	3.64§	1000‡	—	10.59
D	"Sulphurous" alluvial clay	Low-lying but well drained	3.60	520	56	9.63
E	Alluvial clay	Deeply drained†	6.00*	535	58	—

† Estate was neglected in 3rd and 10th years when lalang was allowed to become well established.

* 21st year.

§ In the 6th year yield was 8.53 pikuls p.a. and no. of nuts per pikul = 550.

‡ In 12th year, after the adoption of a system of irrigation, yield rose again to 7.50 p.p.a. and no. of nuts p.p. fell to 723.

A rubberiness of texture is an important defect of Malayan copra and of dwarf palm copra in particular and in this connection it is important to note the opinion of an expert in England when comparing ordinary Malayan copra with the best copra available in the European market. It was stated that when pressure was applied to the copra, the oil flowed satisfactorily but when at the end of the operation the pressure was released, the cake tended to suck up oil owing to the material still having what may be termed a slight elasticity.

A very determined effort is now being made both on estates and in the kampong to advance the quality of Malayan copra in order to obtain an improved price. Where high grade copra is now available in sufficient quantity to command a special price, unsightly pieces of rubbery copra are rigidly excluded and sold separately at a very reduced price.

Information having been received that it is difficult to prepare hard copra from dwarf coconuts, and that dwarf copra is inferior in quality to tall palm copra prepared under good conditions, it was first decided to make a preliminary examination of estate-produced dwarf palm copra, as marketed at the port of shipment. The copra was inspected principally for texture, the pieces being classified as follows :—

Smooth and Crisp :— The brown testa is smooth, the copra will crack, very sharply when bent and there is no excessive shrinkage or distortion.

Rubbery :— The brown testa is rough and corrugated, and the copra, if normally dried, may be bent like rubber without cracking. Such copra is generally shrunken, distorted, unsightly and often broken.

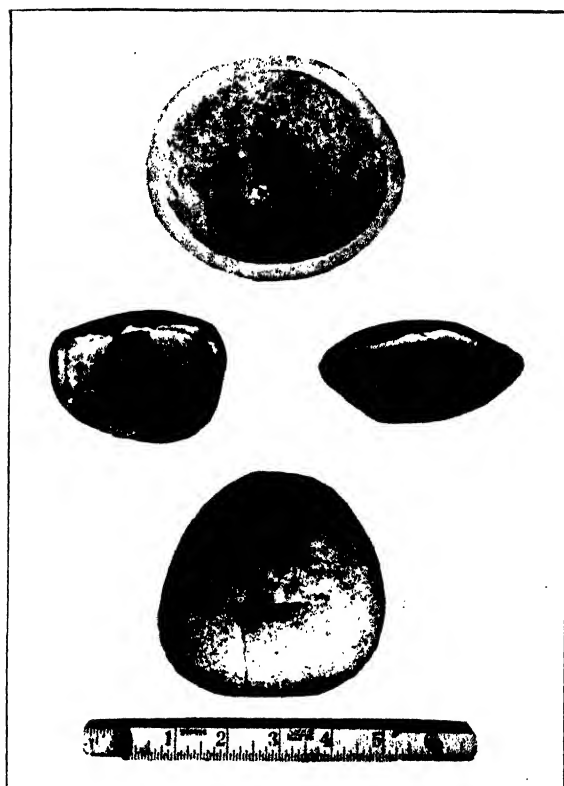
Intermediate :— The copra breaks reluctantly when bent and is often distorted.

The results of the random examination were as follows :—

TABLE III.

An Examination of Estate Produced Dwarf Copra.

Estate	Texture of Copra.		
	Smooth	Crisp	Intermediate
	per cent.	per cent.	per cent.
F	32	30	38
G	28	48	24
H	6	15	79



COPRA FROM TALL AND DWARF PALMS.

Upper and Lower (Tall) :--smooth, round crisp copra.

Centre (Dwarf) :--wrinkled, distorted, rubbery copra.

TABLE IV.
Comparison of Dwarf and Tall Palm Copra from Adjacent Areas on
Different Estates.

SOURCE	DESCRIPTION			PERCENTAGE TEXTURE OF COPRA			General Appearance of Copra.	YIELD	
	Palms	Type	Remarks	Smooth	Crisp	Intermediate	Rubbery	Copra (lbs.) per nut	Nuts per Picul
Government Experimental Plantation Estate D " B " D " B " A Malay Kampong	Tall			98		2	0	.64	208
	"		(best)	97		0	3	.67	200
	"		(best)	92		4	4	.64	208
	"		(worst)	92		2	6	.62	215
	"		(worst)	84		8	8	.54	247
	"			86		4	10	.60	222
	"			84		8	8	.47	284
Government Experimental Plantation Estate E " B	Dwarf	Green		70		20	10	.38	350
	"	"		68		18	14	.36	370
	"	"		38		26	36	.28	370
Government Experimental Plantation Estate D " E Government Experimental Plantation Estate B " A " B " A " D " E	Dwarf	Yellow		30		52	18	.36	477
	"	Mixed	(best)	14		30	56	.27	494
	"	Yellow		12		40	58	.26	513
	"	Red		8		42	50	.34	392
	"	Yellow		6		24	70	.28	477
	"	"	(best)	6		14	80	.26	513
	"	Red		4		32	64	.36	370
	"	Yellow	(worst)	4		16	80	.20	667
	"	Mixed	(worst)	4		8	88	.24	555
	"	Red		4		4	92	.26	513
	"								
	"								

Following this, twenty lots of fifty dwarf and tall palm coconuts were obtained from adjacent fields from five estates, from the Government Coconut Experiment Plantation at Klang, and from a nearby Malay smallholding. The experimental kiln was divided off as required so that copra could be simultaneously produced from all the different lots of nuts, under conditions of manufacture calculated to produce normally a hard smooth and round product.

The various lots of copra obtained were weighed and then tested piece-by-piece. The full results are given in Table IV. When this is examined it will be seen that even under careful conditions of manufacture, and on an under loaded kiln, dwarf coconuts of whatever variety do not yield copra equal in quality to that obtainable from tall palms growing nearby.

It is to be feared therefore that if increasing supplies of dwarf palm copra are ultimately forthcoming or if the general quality of Malayan copra materially advances a large percentage of the copra obtainable from dwarf palms will have to be relegated to a lower grade.

TABLE V.
Summary of Results.

Copra ex	Appearance	Percentage of rubbery pieces	Nuts per picul of copra.
Tall nuts	good	0 — 10	200 — 284
Green dwarfs	fair	10 — 36	350 — 370
Yellow dwarfs	poor	18 — 80	477 — 667
Red dwarfs	very poor	50 — 92	370 — 513

Conclusions.

The conclusions to be drawn may be summarised as follows:—

1. The dwarf coconut palm appears to be more sensitive to unfavourable conditions than the tall palm, and responds rapidly and remarkably to improvement or deterioration in conditions.
2. While very remarkable yields at an early age are obtainable if conditions are favourable, in most instances yields are only fair or poor because the conditions do not fulfil the exacting requirements of the dwarf palm.
3. Free water movement in the soil is essential for good growth and the soil should not be allowed to dry up.
4. The best results have been obtained on very heavy clay.
5. The copra from dwarf palm nuts is of inferior quality to copra prepared from ordinary tall palm nuts on a good kiln, and is unlikely to obtain a premium even if special care is exercised in manufacture.
6. The best dwarf palm copra is obtainable from the green variety, and the worst from the red variety.

PACKING AND TRANSPORT OF PALM OIL.

*Prepared by the Economics Branch of the Department of
Agriculture, S.S. and F.M.S.*

The heaviest items of cost in connection with the manufacture and marketing of palm oil from estates are packing and transport.

At a time when the market price of the oil left ample margin for profit, this high cost was of less importance; also it was unavoidable because of the relatively small quantities of the oil available.

Until recently, Malayan palm oil has been exported in barrels. The barrel usually employed was of Californian Douglas fir on account of the fact that much of the oil was exported to the United States of America where there was a preferential tariff on barrels of American manufacture.

The barrel has a capacity of 40 gallons (375 lbs. of oil) so that six are required per ton of oil. The present cost is \$6.70 each to which must be added the cost of assembly on the estate.

On this basis, barrels for the Malayan palm oil exports of 1931 would have involved a cost of nearly \$200,000. It must be remembered, however, that this sum is not a total loss to the exporter, as oil in barrels commands slightly higher prices than "naked" oil.

Efforts have been made by the Forest Department to select suitable local timber for barrels and to train local coopers. Recent reports* from the Department indicate that some measure of success has been achieved with staves made of wood known as meranti pa'ang, with a bung stave of resak wood.

A local barrel factory has now commenced operations from which satisfactory oil-tight barrels are made of local timbers at competitive prices. Trials of these barrels, which cost \$5 each, are being conducted by Department of Agriculture.

A report received on 20th January 1933, from a firm of London brokers on the condition on arrival of 13 barrels locally made from Malayan timber, containing palm oil, indicated that there was room for improvement in their construction.

The obvious alternative to the export of palm oil in barrels is its export in bulk. In order to make this possible, regular and large supplies must be forthcoming for shipment to buyers of large quantities. The increasing quantity of oil available from the estates controlled by one firm rendered it possible to organise bulk shipment from Malaya in 1931, a description of which is contained in the *Malayan Agricultural Journal* Vol. XIX No. 12.

The net exports of palm oil from Malaya increased from 768 tons in 1927 to 7,905 tons in 1932, while by 1935, the annual Malayan production should

* Monthly Research Bulletin of the Forest Department, S.S. and F.M.S.

exceed 20,000 tons. In view of these facts, further developments in the transport of palm oil are inevitable and desirable.

Land Transport in Bulk.

The Federated Malay States Railways are now operating a scheme for the bulk transport of palm oil on their railway system in tank wagons. They are now in a position to provide suitable tank wagons for the transport of palm oil and to maintain these without charge, making, however, a small additional charge calculated to recover the capital cost of the wagons in the course of a few years. They are also prepared to equip these tank wagons with heating coils and such other fittings necessary as may be mutually agreed between themselves and the consigners.

Sufficient tank wagons will be provided for the conveyance of the oil from any one estate, and if the volume of traffic justifies it, a number of tank wagons will be allotted for the exclusive use of any one sender.

While senders will be solely responsible for the satisfactory cleaning of the tank after use, whether they are reserved for their exclusive use or not, no demurrage will be charged in connection with any tank wagon which may be set apart for the exclusive use of any one sender.

The transport of palm oil in railway tank wagons is in its initial stages. It is already in operation from one station in Selangor and arrangements have been completed to commence its operation in Johore early in 1933. The transport rate for palm oil in railway tank wagons varies, depending on conditions governing each case, such as length of haul. The rates may vary from 4 to 8 cents per ton mile. More definite information can be obtained from the F.M.S. Railways in connection with particular applications.

Water Transport in Bulk to Singapore.

Under arrangements with a local shipping firm it is proposed to construct a tank lighter for the conveyance of palm oil from the coast of Selangor to Singapore.

This lighter will have a carrying capacity of 220 tons and be divided into several tanks in order that it may steam successfully without a full cargo. It is expected that the vessel will be ready for use by the end of May 1933.

The cost of transporting oil by this means to Singapore from the Bernam or Selangor river is anticipated to be in the neighbourhood of \$4 per ton.

Wherever estates are conveniently situated on the river side, oil will be stored in 50 or 100 ton tanks where it can be pumped direct into the lighter. In the case of estates which are inaccessible to the lighter or which have no river frontage, it is proposed to erect a small bulking installation at a convenient site on the Selangor river which will consist of three 100 ton tanks to which oil will

be conveyed either by water or tank lorry from the various estates. The lighter will then call at the installation at regular intervals to transport the oil to Singapore for trans-shipment.

Bulk Storage at Port.

The use of tank railway wagons entails special facilities at the port for the reception and storage of the oil until such time as it can be loaded into specially prepared tanks in ocean ships.

Such port facilities are at present being arranged by the Singapore Harbour Board. This Board has arranged to provide an installation of three tanks of 500 tons each, with the relative pumping apparatus. The installation is so arranged that oil can be received either by rail or sea.

The Singapore Harbour Board is to lease this installation to a local firm which is closely and extensively connected with the cultivation of oil palms.

Subject to sanction of the Singapore Harbour Board it is the intention of this firm to grant a sub-lease on almost identical terms and at the same rental to a Service Company to be locally formed to operate the installation purely as a transport organisation, the object being to provide facilities for bulk shipment at the lowest possible terms and at the same terms for all producers. There will be no discrimination as between producers in the charges for the use of the installation which will operate on a definite non-profit earning system.

The capital required will be almost nominal and is being provided by the palm oil producers in proportion to their interests.

The estimated cost of reception at the installation and subsequent pumping on board ship is estimated not to exceed \$5 per ton, but in the absence of actual experience this estimate is necessarily tentative. The cost will naturally vary with the quantity handled and with increasing production it should become less.

There is no intention that the Service Company shall buy or sell oil on behalf of producers. It is recognised that bulk transport may give rise to difficulties in the case of small producers, but the Managing Agents of the Service Company state that they will do all they can to assist such producers.

The provision of better transport facilities for bulk shipment of palm oil, such as are being put into operation, is estimated to effect a saving of fully £5.10.0 per ton to producers, which will be a very distinct gain to estates which in many cases must now be working on a very small margin between profit and loss.

NOTES ON CERTAIN SUBMERGED AQUATIC WEEDS IN PADI FIELDS.

BY

N. H. SANDS.

Agricultural Officer — Kedah.

In Kedah during the past season, when the rainfall over a period of 3 months was fairly continuous, submerged aquatic weeds became exceedingly abundant in the flooded padi fields of the Telok Chengai Experiment Station and elsewhere, and by forming in dense masses around the young padi plants checked considerably their growth and development. The planting of padi was completed in the Station on August 20th, and 18 days later it was observed that the aquatic weeds *Utricularia flexuosa*, Vahl., and *Blyxa Malayana*, Ridl., were fairly numerous. The former is an insectivorous plant with long very finely divided leaves to which are attached bladder traps; the latter is a stemless plant with a rosette of long narrow grass-like leaves. Little importance was attached to these as in previous years they were present, but not in large numbers.

The first weeding of the fields was carried out in the second week of September, but by October 6th, masses of *Utricularia* and two other aquatic plants were observed whose growth was so excessive that constant weeding was subsequently necessary in order to maintain the padi in a healthy condition.

The additional plants were *Enhydnias angustipetala*, Ridl., and *Chara gymnophytis*, Brann. Those two species, together with *Utricularia flexuosa* are known collectively as 'lumut' (moss). *Enhydnias* has long thin stems and numerous short narrow leaves, whilst the *Chara* is densely branched, with the branches covered by large masses of very small leaf-like organs. If left for even a few days the whole surface of the soil becomes carpeted by these weeds.

The reason for the rapid growth of the plants could only be accounted for by the fact that during September, October and November, the rainfall was sufficiently frequent and heavy to maintain a high water-level in the fields: the precipitation being as under:—

September	October	November
9.40 ins.	12.51 ins.	16.23 ins.

From the 23rd October to 8th November—a period of 17 days—no less than 16.96 inches of rain were recorded.

It was at one time thought that the practise of spreading the straw after harvest in the Station, instead of burning it, as is the common local method, might have produced conditions favourable to the growth of 'lumut', but in surrounding fields where the straw had been burnt, the weeds were equally

numerous, so that there was little doubt but that the heavy rainfall was responsible for their abnormal development.

Local planters state that after an interval of a few years these aquatic plants become very troublesome, so much so, that some growers have been known to broadcast salt in their fields after harvest. This practice may be the result of observations made in areas near to the coast where these particular weeds are said not to thrive.

The removal of masses of submerged growth by hand from the fields was laborious, slow and expensive so that a specially designed tool was made to facilitate the work. This took the form of a rake with a number of bent pointed $\frac{1}{4}$ inch iron tines. The tines were joined together at the base and spread out fanwise. The best spacing of tines was found after trial to be 1 in. to $1\frac{1}{4}$ in. but the number of tines would vary according to the spacing of the plants—8-9 being the most suitable number for plants spaced from 15 ins. to 18 ins. apart. The length of a tine from base to point was 16 ins. The total length of the tool with handle being about 4 feet and the cost from two to three dollars.

The rake proved very useful, not only for enabling the weeds to be quickly collected in heaps, but also served to cultivate lightly the soil around the plants. The rake could also be used for shallow-rooted and floating aquatic plants which often thrive in wet padi areas.

Abstract.

PRESENT-DAY TEA CULTIVATION IN SOUTH CHINA.

By Dr. A. Steinmann. *De Bergcultures*, 1932, No. 39, pages 1027—30.

In view of the comparatively large imports of China tea into Malaya it is thought that a summary of a translation of the above article will be of local interest. China is still by far the largest grower though the greater part of its produce is consumed within the country. The manufacturing methods described in this article are similar to those employed by Chinese growers in Malaya. A description of local manufacture was published in the Malayan Agricultural Journal, Vol. XVII, page 12.

The exports of tea from China have fallen considerably during the last sixty years. Whereas in 1867 China possessed 90 per cent. of the world's tea trade, in 1905 it had fallen to 29 per cent. and since then it has declined still further. This loss of trade is due mainly to the fact that China proved to be incapable of modernising its methods of production against increasing competition from other countries, notably Ceylon, Java and Japan.

In this paper Dr. Steinmann describes a visit to a tea plantation near Canton in the Tsing Yuen district. A large number of small-holdings devoted to tea cultivation are located on the slopes of hills round the Pi-Ka mountains. The estate visited and described was situated at an elevation of about 660 feet above sea level on these hills. The soil is stony and the surrounding vegetation consists of grasses and ferns. At irregular intervals throughout the tea plantations, clumps of *Pinus Massoniana* are closely interplanted. These trees serve as a source of firewood and are a common feature of the scenery near Hong Kong and Canton. The tea cultivated is raised from seed from indigenous plants found growing in the Pi-Ka mountain range.

Seed for sowing is collected in August and sown during the rains in the following February. Throughout the interval the seed is exposed to sunlight on trays of plaited bamboo to keep it as dry as possible. The land is lightly cultivated and the seed sown directly in the field, three to four seeds per hole. Successes ranging from 80 to 90 per cent. are claimed to be obtained. The tea bushes are planted in rows two feet apart, the spacing in the rows being about one foot between each plant. As the tea bushes mature the pine trees are removed. Manure is not generally used but farm manure and ground nut cake are employed on many holdings.

Plucking commences when the tea bushes are three years old. On the estate visited eight pluckings are undertaken during the year. The plucking routine is as follows: two pluckings in April, followed by pruning in May, and the bushes rested until the end of July. Three pluckings in August followed by a rest in September. A further three pluckings in October after which the bushes are pruned and rested until the succeeding year. The first plucking in

April and August consists of buds from the axils of the leaves yielding the first quality tea. During the growing period after pruning, between May and August, the shoots became 3 to 5 inches long. The secondary shoots formed in September provide a crop which is plucked in three relays during October. Since rain is considered detrimental to the crop, picking is done as far as possible during fine weather.

Manufacture is very primitive, and is undertaken at evening by the same men who have plucked the leaf during the day. The crop, without previous withering, is dried directly in iron pans over a fire until the leaves are soft and can be rolled. The time required varies according to the intensity of the fire but is usually half an hour. The leaves are first rolled with the hand for a quarter of an hour and become darker in colour. Finally the leaves are dried, partly in the sun and partly in iron pans.

The manufactured tea is packed in bamboo baskets and transported to Canton. After blending, and in some cases perfuming, most of the tea is packed for local sale.

J. N. M.

Departmental.

FROM THE DISTRICTS.

The Weather.

Hot and fairly dry conditions prevailed over most of the Peninsula for the first three weeks of the month with a tendency towards heavier rainfall during the last week in Krian, Province Wellesley and Perak.

An exception in the matter of rainfall was the coastal region from Singapore to Malacca where heavy rain was experienced during the second week of the month and the total figures for the month in this area were above average for March, many heavy downpours being experienced.

In Selangor and Negri Sembilan the precipitation was average for the month. The effects of the mid-month wet period mentioned in the preceding paragraph extended inland to parts of Negri Sembilan.

Over the remainder of the inland region comprising Kedah, Province Wellesley, Perak and West Pahang the rainfall was generally below normal for March.

In the East Coast region the figures approximate closely to the average records for the month.

Remarks on Crops.

Rubber. Little change occurred in the range of local prices offered for small-holders' rubber. The highest and lowest prices recorded in dollars and cents per picul are—Smoked Sheet, \$5 to \$8.50; Unsmoked Sheet, \$4 to \$7; Scrap 70 cents to \$3. The average Singapore price for small-holders' rubber was \$7.60 for Smoked Sheet, \$6.80 for Unsmoked Sheet and \$2.50 for Scrap.

Owing to the continuance of dry weather Mouldy rot disease was generally quiescent, but reports of the presence of leaf mildew, *Oidium Heveae*, have been received from Province Wellesley, Negri Sembilan, Malacca and Johore.

In Province Wellesley only a few mild cases were noted.

In Negri Sembilan the area specially concerned was that between the coast and the main range. In Malacca there was a general outbreak, the chief centre being Alor Gajah. In Johore three estates reported the disease whilst several areas of small holdings were affected, especially in Tangkah area, where the disease has been noted before, and around Parit Karoma and Labis.

The Rubber Research Institute gave some demonstrations at Bhutan Estate, Nilai, of dusting, using three different machines and different preparations of sulphur powder.

An appreciable increase in the number of untapped holdings is reported from Province Wellesley and Krian where the harvesting of padi demanded attention.

Padi. Yields of the recently harvested crop in Kedah and Province Wellesley are stated to have been very satisfactory. In Kedah, actual figures of the estimated crop are not yet available, but for Province Wellesley it is stated that the average return per acre is approximately 300 gantangs, whilst in Penang the average is over 400 gantangs per acre. With regard to Krian the yields have been very good over the South-eastern portion of the District, but are only moderate over the North-western portion. Some still remains to be reaped in the last mentioned half of the District. A feature of the Krian harvest has been the large volume of business transacted by the Government Rice Mill, Bagan Serai, where the buying price for padi has been maintained at \$1.62 per pikul. In Negri Sembilan, preparations for planting the next crop have begun, except in Kuala Pilah District where dates follow more closely the general season for the main padi areas of the Western portion of the Peninsula. In this District an attempt is being made to produce two crops in the year on an area near Sri Menanti. Clearing is in progress preparatory to planting the first short season crop. In Pahang crop returns are not yet completed but are available for Temerloh and Bentong Districts where, as anticipated, both total yield for the area and the average return per acre is computed to be higher than for last season. Preparations for the next crop have begun in the riverine mukims of Pahang and in Johore.

Coconuts and Copra. The price of copra has declined during the month, the lowest Singapore quotation being \$3.55 per pikul for mixed copra. In areas where the demand for eating nuts is an important factor such as Penang and Province Wellesley the price of nuts for copra production has not fallen in the same ratio as the copra price and, consequently, some small manufacturers of copra have sustained a loss on their working.

Further progress on the improvement of kilns erected by small-holders is recorded. In the Sungei Acheh area of Province Wellesley a further kiln has commenced production and another is completed. In the Bagan Datoh area, improvements recommended for a brick kiln have been carried out and another brick kiln is in course of construction. A survey of the Chinese kilns in Central District of Malacca revealed that 50 are in existence but all are of faulty construction. Advice on the nature of improvements needed was given.

Samples of copra received from Johore were reported upon by the Assistant Chemist for Copra Research.

Tobacco. Renewed interest in this crop is reported from Province Wellesley where the best quality cured leaf realised \$45 a pikul and medium quality \$30. Interest in the crop is maintained in Singapore by Chinese market gardeners who dispose of green leaf to manufacturers of Chinese and cigar types of tobacco.

Agricultural Stations.

Considerable further progress was made during the month on planting up the Bukit Mertajam Station in Province Wellesley. At other stations, arrangements have been made with a view to having planting material ready for further planting and for supplies during the anticipated wet weather of next month. At Singapore, the yields on the Pineapple Station have noticeably fallen off, indicating the close of the first fruit season. In the series of cultural trials yields from the Pabco mulched plots have been the highest.

Padi Stations and Test Plots.

Many records of yields for manurial, cultural and varietal trials have been received at headquarters for statistical examination and weighing of the remainder is in progress. Records from all stations are expected to be completed shortly. Next season's programme for varietal trials at the stations in Pahang, Johore, Selangor and Negri Sembilan, where planting is early, have been laid down and in many cases the seed has been sown.

DEPARTMENTAL NOTES.

Visits and Tours.

Dr. H. A. Tempany, C.B.E., Director of Agriculture, visited Singapore from the 8th to the 11th of March. During his visit he inspected the Pineapple Experimental Station, and visited the Singapore Cold Storage Company's Dairy Farm at Bukit Timah.

The Director also made a tour of the districts in the Negri Sembilan from March 20th to 22nd. He was accompanied by the Chief Field Officer, Mr. F. Birkinshaw; the Agricultural Field Officer, Negri Sembilan, Mr. W. H. Barnes, and Mr. R. G. H. Wilshaw who has been appointed to succeed Mr. Barnes on the latter's retirement. The opportunity was taken, during the tour, to discuss matters of policy with the Administrative officers in many of the Districts.

On March 26th the Director, accompanied by the Acting Agricultural Chemist, Major C. D. V. Georgi, O.B.E., was present at the opening, by H.H. The Sultan of Johore, of the new oil palm factory on Ulu Remis Estate, Layang-Layang, Johore.

In the first week of March the Government Entomologist visited several coconut estates in the Bagan Datoh area in order to discuss with the managers the economic relationship of an insect pest (*Setora nitens*) to the coconut industry. He also visited Cameron Highlands from March 13th—16th to enquire into the "cut-worm" situation and to supervise the layout of experiments for the control of this pest.

The Acting Government Mycologist, Mr. A. Thompson, visited Cameron Highlands from the 6th to the 9th March and an oil palm estate in Johore from 12th to 14th in order to investigate problems connected with the control of certain diseases.

The Singapore-Johore Agri-Horticultural Show.

The Singapore - Johore Agri - Horticultural Show was held in the grounds of the New World Pleasure Park, Singapore, on April 7th, 8th and 9th, 1933.

It is many years since a similar show has taken place in Singapore and the effort may be taken as marking a decided step in advance.

The Exhibition was organised by a Committee presided over by Mr. John Laycock and comprised representatives of agricultural and horticultural interests in Singapore and Johore as well as members of the staff of the Agricultural and Gardens Departments in Singapore and Johore.

The show was opened by His Excellency Sir Cecil Clementi on April 7th at noon amid a representative gathering among those present being Lady Clementi, the Hon'ble Sir John Scott, Colonial Secretary, the Hon'ble Mr. A. S. Haynes, His Highness the Sultan of Kelantan, Dr. Tempany, Director of Agriculture, the Hon'ble Mr. J. Bagnall, Sir David Galloway and many others.

In his speech His Excellency alluded to the necessity for growing crops

other than rubber and touched on the possibilities of increasing the production of flowers on a commercial scale in Singapore.

The Director of Agriculture thanked His Excellency on behalf of the organisers of the Show for his address and for opening the Exhibition. He stressed the importance of shows in the campaign for broadening the basis of agriculture in Malaya, which has been in progress for some time past.

After the opening His Excellency inspected the exhibits.

The show was also visited on the 7th instant by Their Highnesses the Sultan and Sultana of Johore, who were accompanied by His Highness the Tungku Mahkota. Their Highnesses spent several hours examining the exhibits.

The general standard of the exhibits was high. In addition to a large number of agricultural exhibits there were many entries in the classes for flowers, particularly orchids, vegetables and fruit. The Department of Agriculture staged an exhibit of copra, oil palms, pineapples, and minor economic products (tea, coffee and tuba). Great interest was shown in these exhibits, especially in the demonstration of the striking results obtained by the manuring and mulching of pineapples at the Singapore Pineapple Station. During the evenings, the Co-operative Department displayed their propaganda film.

The attendance during the three days has been estimated at between thirty-five and forty thousand, and the show is considered to have been an unqualified success. It is hoped that as a result of this effort the show may become established as an annual event and prove a useful stimulant to agriculture and horticulture in Singapore and Johore.

Staff Changes and Leave

Mr. A. Sharples, Government Mycologist, and, at present Head of the Pathological Division of the Rubber Research Institute of Malaya, retired from Government Service on December 28th 1932.

Mr. F. S. Ward, Assistant Mycologist, has been granted full-pay leave of four months and twenty eight days, from March 22nd to August 18th, prior to retirement on abolition of appointment.

Mr. W. H. Barnes, Agricultural Field Officer, Negri Sembilan, has been granted full-pay leave, prior to retirement, from April 1st to October 1st.

Mr. R. G. H. Wilshaw, Assistant Chemist, has been seconded to the Field Branch, and assumed duty as Agricultural Field Officer, Negri Sembilan, on April 1st.

Statistical.

MARKET PRICES.

March, 1933.

Rubber.—The highest price recorded in Singapore during March for rubber smoked sheet, equal to London Standard was 6 5/16 cents per lb. on the 4th, and the lowest price 5 14/16 cents on 7th. The average price for the month was 6 1/32 cents per lb. in Singapore, 2 1/32d. London and 31/32 cents gold New York, as compared with 6 4/16 cents, 2d. and 30.1/16 cents gold respectively in February 1933.

Palm Oil.—The course of the English market during the month of March, on a basis of 18 per cent. f.f.a., c.i.f. Liverpool, was as follows; 2nd, £13.10.0 per ton; 9th, £14.5.0; 16th, £14.5.0; 23rd, £13.15.0; 30th, £15.0.0. Prices in the U.S.A. landed weight c.i.f. New York/Philadelphia, were 2.20 cents gold per lb. on 6th, and 2.30 cents gold on 25th of the month.

The price of palm kernels, Fair Average Malayan Quality, c.i.f. landed weight on the Continent ranged between 8 shillings and 7½d. per cwt. and 8 shillings and 10½d. during March.

Copra.—The highest Singapore price for sundried during March was \$4.55 per picul in the middle of the month, falling to \$3.90 per picul at end of month, the average price being \$4.35 per picul as compared with \$4.75 in February. The mixed quality averaged \$4.03 as compared with \$4.32 in the previous month.

Copra cake averaged \$1.92 per picul.

Coffee.—The prices at Singapore for Sourabaya coffee ranged from \$24.50 to \$25.75 per picul, as compared with \$25.40 to \$27.50 during February, the price within the range depending upon quality.

Palembang coffee averaged \$19.80 per picul as compared with \$20.40 in February.

Arccanuts.—Palembangs averaged \$2.16 per picul and Bila Whole averaged \$2.45 as compared with \$2.25 and \$2.49 per picul respectively in February. Singapore average prices for other grades were:—Split \$2.90 to \$4.50, Red Whole \$2.50 to \$4.25, Sliced \$5 to \$7 per picul, the price within each range depending on quality. The price for Kelantans was quoted at from \$4.25 to \$4.60.

Rice.—The following are the average wholesale prices per picul of rice in Singapore during February:—Siam No. 2 \$3.41, Rangoon No. 1 \$3.26, as compared with \$3.40 and \$3.24 per picul during January. The average retail market prices in cents per gantang of No. 2 Siam rice in February were:—Singapore 25, Penang 28, Malacca 27, as compared with 25, 29 and 27 cents respectively in January.

Gambier.—Block Gambier has remained steady throughout the month at \$5 per picul and Cube at \$8 per picul.

Pineapples.—The average Singapore prices per case in March were:—Cubes \$2.95, Sliced Flat \$2.80, Sliced Tall \$3.04, as compared with \$3.19, \$2.90 and \$3.21 respectively during February.

Tapioca.—There has been a decline in prices towards the end of the month. Flake depreciated from \$7.00 to \$4.50 per picul towards the end of the month, and Pearl from \$7 to \$5, the average price per picul of the latter being \$5.69 as compared with \$5.25 during February.

The price of Flake averaged \$5.69 as compared with \$4.85 in February and Pearl medium averaged \$6.12 as compared with \$5.44 in the previous month.

Sago.—Pearl small fair rose slightly during the month, the average being \$4.31. Flour Sarawak Fair averaged \$1.90 as compared with \$1.94 in February.

Mace.—Prices, more or less nominal, are quoted at \$62 per picul for Siouw and \$40 for Amboina.

Similar prices have ruled for the past four months.

Nutmegs.—The average Singapore prices per picul for 110's were \$20.50 per picul and 80's \$24.50 per picul, as compared with \$21.25 and \$25.12 per picul respectively during February.

Pepper.—Average Singapore prices during March were as follows:—Singapore Black averaged \$15 per picul, Singapore White \$21.31 and Muntok White \$21.75, the corresponding prices for February being \$15.50, \$19.75 and \$16.62 respectively.

Cloves.—There has been no demand for cloves, nominal prices being quoted at \$40 for Zanzibar and \$45 per picul for Amboina.

The above prices are based on London and Singapore daily quotations for rubber; the Singapore Chamber of Commerce Weekly Reports for the month and on other local sources of information. Palm oil quotations are kindly supplied by Messrs. Cumberbatch & Co., Ltd. and Messrs. Guthrie & Co. Ltd., Kuala Lumpur, and the Singapore prices for coffee and arecanuts by the Lianqui Trading Company of Singapore.

1 picul = 133½ lbs. The Dollar is fixed at 2s. 4d.

Note.—The Department of Agriculture will be pleased to assist planters in finding a market for agricultural products. Similar assistance is also offered by the Malayan Information Agency, 57, Charing Cross, London, S.W. 1.

GENERAL RICE SUMMARY.*

February 1933.

Malaya.—Gross foreign imports of rice (including stocks available for re-export) during February 1933, amounted to 46,275 tons, as compared with 62,573 tons in February 1932, a decrease of 26 per cent. of which 62 per cent. was imported into Singapore, 17 per cent. to Penang, 5 per cent. to Malacca, 14 per cent. to the Federated Malay States and 2 per cent. to the Unfederated Malay States.

Of these imports, 61 per cent. were from Siam, 35 per cent. from Burma, 3 per cent. from Indo-China and 1 per cent. from other countries.

Total foreign exports of rice from Malaya in February 1933, were 13,975 tons (including 219 tons local production) as compared with 16,346 tons in February 1932, or a decrease of 15 per cent.

Of these exports 83 per cent. were consigned to Netherlands India and 17 per cent. to other countries.

Net imports for the period January - February 1933, were 67,152 tons as compared with 80,564 tons during the same period for 1932, a fall of 17 per cent.

India and Burma.—Total foreign exports of rice during January 1933 were 68,000 tons as compared with 109,000 tons in December 1933, and 168,000 tons in January 1932, a decrease of 38 per cent. in respect of the previous month and a decrease of 60 per cent. in respect of the same period in the previous year.

Total exports of rice and bran from Burma during the period 1st January to 25th February 1933, amounted to 429,928 tons as compared with 600,549 tons in the corresponding period of 1932, a decrease of 28 per cent.

Japan.—No returns.

Formosa.—The area under padi (second crop) in 1932, was 941,108 acres as compared with 887,760 acres in 1931, an increase in area of 6 per cent.

Production was estimated to be 663,000 tons in 1932, as compared with 540,000 tons in 1931, an increase of 25 per cent.

Siam.—Exports of rice from Bangkok (approximate) during February 1933, amounted to 142,051 tons as compared with 114,668 tons (actual) in February 1932, an increase of 23.9 per cent.

Netherlands India, Java and Madura.—For the month of January 1933, the area harvested amounted to 189,000 acres, a decrease of 2,000 acres or 1 per cent. as compared with the corresponding period of 1932; the area damaged was 2,000 acres a decrease of 2,000 acres or 50 per cent. as compared with January 1932, and additional plantings awaiting harvesting amounted to 5,114,060 acres a decrease of 257,940 acres or 5 per cent. The total acreage at the end of January 1933, amounted to 5,305,000 acres, a decrease of 262,000 acres or

* Abridged from the Rice Summary of February 1933, compiled by the Department of Statistics, S.S. and F.M.S.

5 per cent. as compared with the same month in 1932.

Imports of rice into Java and Madura during January 1933, totalled 17,152 tons, an increase of 1,239 tons or 8 per cent. as compared with the same month in 1932.

Imports of rice into the Outer Provinces during the period January to December 1932, amounted to 273,347 tons, a decrease of 48,509 tons or 15 per cent. as compared with the same period of 1931.

French Indo-China.—Entries of padi at the port of Cholon during January and February 1933, amounted to 192,000 (metric) tons, an increase of 2,000 tons or 1 per cent. as compared with the same months in 1932.

Export of rice from Saigon for the period January to February 1933, totalled 188,000 tons, the same figure as that shown for the corresponding period of 1932.

Ceylon.—Imports for the month of January 1933, totalled 36,412 tons, a decrease of 6,774 tons or 16 per cent. on the imports for January 1932.

Of these imports 23 per cent. were from British India, 67 per cent. from Burma and 10 per cent. from other countries.

Europe and America.—Quantities of rice shipped from the East were :—

- (a) To Europe for the January 1st February 23rd, 1933, 145,146 tons, an increase of 74,042 tons or 104 per cent. as compared with the same period of 1932. Of these shipments 28 per cent. were from Burma, 11 per cent. from Japan, 53 per cent. from Saigon, 7 per cent. from Siam and 1 per cent. from Bengal, as compared with 60 per cent. from Burma, nil from Japan, 35 per cent. from Saigon, 3 per cent. from Siam and 2 per cent. from Bengal in 1932.
 - (b) To the Levant, period January 1st to January 25th 1933, 86 tons as compared with 5,680 tons in the same period of 1932.
 - (c) To America and the West Indies for the period January 1st to January 25th; nil as compared with 13,140 tons in the same period of 1932.
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MALAYA RUBBER STATISTICS

ACREAGES OF TAPPABLE RUBBER NOT TAPPED ON ESTATES OF 100 ACRES AND OVER, FOR THE MONTH ENDING FEBRUARY, 1933.

STATE OR TERRITORY (1)	Acreage of Tappable Rubber end 1932 (2)	ESTATES WHICH HAVE ENTIRELY CEASED TAPPING		ESTATES WHICH HAVE PARTLY CEASED TAPPING		Total (3) + (5) (7)	Percentage of (7) to (2) (8)
		Acreage (3)	Percentage of (3) to (2) (4)	Acreage (5)	Percentage of (5) to (2) (6)		
FEDERATED MALAY STATES :—							
Perak	250,951	13,753	5.5	31,937	12.7	45,690	18.2
Selangor	308,379	17,997	5.8	39,854	12.9	57,851	18.8
Negri Sembilan	228,541	19,638	8.6	21,909	9.6	41,547	18.2
Pahang	38,141	9,623	25.2	3,926	10.3	13,549	35.5
Total F.M.S. ...	826,012	61,011	7.4	97,626	11.8	158,637	19.2
STRAITS SETTLEMENTS :—							
Province Wellesley	44,734	2,019	4.5	9,301	20.8	11,320	25.3
Dindings	6,969	404	5.8	959	13.8	1,363	19.6
Malacca	111,780	5,948	5.3	22,689	20.3	28,637	25.6
Penang Island	1,635	1,278	78.2	50	3.1	1,328	81.2
Singapore Island	28,269	13,523	47.8	3,698	13.1	17,221	60.9
Total S.S. ...	193,387	23,172	12.0	36,697	19.0	59,869	31.0
UNFEDERATED MALAY STATES :—							
Johore	325,747	43,469	13.3	33,358	10.2	76,827	23.6
Kedah (a) (c)	107,857	9,304	8.6	8,202	7.6	17,506	16.2
Kelantan	21,175	11,063	52.2	1,452	6.9	12,515	59.1
Trengganu (b)	4,352	Nil	Nil	2,072	47.6	2,072	47.6
Perlis (c)	957	106	11.1	502	52.5	608	63.5
Total U.M.S. ...	460,088	63,942	13.9	45,586	9.9	109,528	23.8
TOTAL MALAYA ...	1,479,487	148,125	10.0	179,909	12.2	328,034	22.2

Notes :— (a) Registered companies only and are rendered quarterly.

(b) Registered companies only.

The above table together with a Summary, was prepared and published by the Statistics Department, S.S. and F.M.S. in March 1933.

MALAYAN AGRICULTURAL EXPORTS, JANUARY, 1933.

PRODUCT	Net Export in Tons		
	Year 1932	January 1932	January 1933
Arecanuts ...	20,280	3,073	2,407
Coconuts, fresh ...	108,123*	6,559*	7,015*
Coconut oil ...	11,932	959	1,618
Copra ...	97,464	5,494	14,584
Gambier, all kinds ...	1,925	246	181
Palm kernels ...	1,248	45	65
Palm oil ...	7,892	392	405
Pineapples, canned ...	66,261	5,623	4,713
Rubber ...	417,137	41,952	35,822
Sago,—flour ...	10,267	1,178	656
" —pearl ...	3,228	254	129
" —raw ...	4,148†	243†	495†
Tapioca,—flake ...	9,028	534	940
" —flour ...	392	22	315
" —pearl ...	19,977	1,325	1,056
Tuba root ...	165‡	5†	4

* hundreds in number.

† net imports.

MALAYAN AGRICULTURAL EXPORTS, FEBRUARY, 1933.

PRODUCT.	Net Exports in Tons.				
	Year 1932	Jan.-Feb. 1932	Jan.-Feb. 1933	February 1932	February 1933
Arecanuts ...	20,280	4,400	4,533	1,367	2,126
Coconuts, fresh ...	108,123†	13,217†	16,154	6,658†	9,139†
Coconut oil ...	11,932	1,711	2,960	752	1,342
Copra ...	97,464	13,053	18,991	7,559	4,407
Gambier, all kinds ...	1,925	503	394	255	213
Palm kernels ...	1,248	170	199	125	134
Palm oil ...	7,892	821	562	429	157
Pineapples, canned ...	66,291	11,936	9,025	6,313	4,312
Rubber ...	417,137	74,983	67,388	32,972	31,559
Sago,—flour ...	10,267	3,028	1,369	1,850	713
" —pearl ...	3,228	451	348	197	219
" —raw ...	4,148*	578*	767*	335*	272*
Tapioca,—flake ...	9,028	1,326	1,915	792	965
" —flour ...	392	87	364	65	49
" —pearl ...	19,977	2,444	2,418	1,212	1,362
Tuba root ...	165‡	12	43	7	39

† hundreds in number.

* net imports.

TABLE I
MALAYA RUBBER STATISTICS
STOCKS, PRODUCTION, IMPORTS AND EXPORTS OF RUBBER, INCLUDING LATEX, CONCENTRATED LATEX AND REVERINEX,
FOR THE MONTH OF FEBRUARY, 1933 IN DRY TONS.

Territory	Stocks at beginning of month 1			Production by Estates of less than 100 acres and over			Imports			Exports including re-exports during the month			Stocks at end of month		
	Dealers	Estates and over	Ports	January	February	March	From Foreign	From Malay States	From Straits Settlements	Foreign	Local	Local	Ports	Dealers	Estates and over
	2	3	4	5	6	7	9	10	11	12	13	14	15	16	17
MALAY STATES:—															
Federated Malay States	13,980	13,052	10,975	22,501	6,232	14,412	Nil	Nil	Nil	Nil	6,358	26,815	12,325	...	12,594
Johore	2,433	3,133	3,609	6,749	3,787	7,958	Nil	2	Nil	5	928	5,881	1,873	12,686	3,493
Kedah	730	2,586	2,050	4,681	956	2,254	Nil	Nil	Nil	Nil	1,189	2,394	2,284	5,277	2,133
Perlis	32	21	8	18	5	23	Nil	Nil	Nil	Nil	20	Nil	40	...	18
Kelantan	97	137	159	286	197	393	Nil	Nil	Nil	Nil	40	297	130	577	31
Trengganu	55	50	69	156	34	78	Nil	Nil	Nil	Nil	Nil	103	Nil	234	50
Total Malay States	17,327	18,989	16,870	34,591	11,211	25,118	Nil	2	Nil	5	14,227	15,053	31,102	31,139	16,036
STRAITS SETTLEMENTS:—															
Malacca	6,494	1,513	1,210	2,579	...	...	Nil	Nil	9	...	3,686	...	7,618	...	6,378
Province Wellesley	1,087	704	441	1,066	...	...	Nil	Nil	Nil	31,204	...	...	14,354	...	1,087
Dindings	26	120	91	192	...	...	Nil	15,083	996	...	6,545	...	...	...	28
Penang	1,538	5,334	10	1	...	...	4,556	...	9,980	...	13,036	...	...	...	4,489
Singapore	4,473	16,824	181	143	278	...	4,372	...	...	...	...	...	...	...	8
Total Straits Settlements	6,011	29,735	2,538	1,866	4,088	1,592	4,828	15,083	10,985	31,204	23,267	Nil	53,061	Nil	196
TOTAL MALAYA	6,011	47,062	21,517	18,756	38,479	12,803	4,828	15,085	10,985	31,209	37,564	15,063	84,163	31,139	5,732

TABLE II

DEALERS' STOCKS, IN DRY TONS

Class of Rubber	Federated Malay States	Singapore	Penang	Province Wellesley	Johore	Total
20	21	22	23	24	25	26
DRY RUBBER	9,692	15,079	4,032	7,278	1,024	37,105
WET RUBBER	3,802	1,561	457	215	1,638	6,773
TOTAL	12,594	16,640	4,489	7,493	2,662	43,878

TABLE III

FOREIGN EXPORTS

PORTS	For January 1933
Singapore	22,023
Penang	9,518
Port Swettenham	3,230
Malacca	793
MALAYA	37,564

TABLE IV

DOMESTIC EXPORTS

AREA	For January 1933
Malay States	32,072
Straits Settlements	71,695
MALAYA	32,072

- Notes:—1. Stocks on estates of less than 100 acres and stocks in transit on rail, road or local steamer are not ascertained.
 2. The production of stocks of less than 100 acres is estimated from the formula: Production + Imports + Stocks at beginning of month = Exports + Stocks at end of month. + Consumption, i.e., Column [18] + Column [19] + [14] + [17] + [19A] - [2] - [18] - [41] - [15] - [9] - [10]. For the Straits Settlements, Columns [7] and [8] represent purchases by dealers from local estates of less than 100 acres, reduced by 18.70 tons of dry rubber.
 3. Dealers' stocks are estimated by deducting the average monthly dry weight as reported by the dealers themselves.
 4. Domestic exports are estimated by deducting the average monthly dry weight of foreign imports over a period of 2 months from the gross foreign exports of the later month, the foreign exports of the Malay States being domestic production.
 5. The above, with certain omissions, is the Report published by the Registrar-General of Statistics, S.S. and F.M.S., at Singapore on 21st of February 1933.

METEOROLOGICAL SUMMARY, MALAYA, FEBRUARY, 1933.

Locality	AIR TEMPERATURE IN DEGREES FAHRENHEIT					EARTH TEMPERATURE		RAINFALL						BRIGHT SUNSHINE					
	Means of		Absolute Extremes			PERATURE		Total		Most in a day		Number of days				Total	Daily Mean	Per cent	
	A.	B.	Mean of A and B	Highest	Lowest	Min.	Max.					Precipitation .01 in or more	Thunder-storm	Fog morning obs.	Gale force 8 or more				
	Max.	Min.	° F	° F	° F	° F	° F	At 1 foot	At 4 feet	in.	mm.	in.	in.	in.	hr.	hr.	hr.		
Railway Hill, Kuala Lumpur, Selangor	92.1	71.1	81.6	95	69	89	73	83.8	84.4	13.54	343.9	3.93	16	12	5	10	206.50	7.37	61
Bukit Jeram, Selangor	88.6	71.8	80.2	91	70	86	74	85.2	86.4	5.42	137.7	2.97	10	7	1		240.80	8.60	72
Sitiawan, Perak	90.6	71.6	81.0	93	69	87	75	84.5	84.6	3.64	92.5	1.43	9	7	2	2	241.25	8.62	72
Kroh, Perak	90.6	65.7	78.1	93	62	83	71	81.0	81.0	1.26	32.0	0.89	6	4	1		251.20	8.97	75
Temerloh, Pahang	88.5	70.1	79.3	92	66	85	73	83.9	84.3	1.26	32.0	1.04	4	3			226.05	8.07	67
Kuala Lipis, Pahang	88.6	69.6	79.1	91	65	85	74	82.7	82.9	2.23	56.7	0.80	9	7	15		211.30	7.55	63
Kuala Pahang, Pahang	84.3	73.1	78.1	87	67	82	78	84.4	83.9	2.31	58.7	1.07	6	5			243.65	8.70	73
Mount Faber, Singapore	88.5	71.0	79.7	92	69	78	74	81.2	82.0	1.92	48.8	0.53	7	7	1		206.20	7.36	61
Butterworth, Province Wellesley	88.4	71.6	80.0	90	69	86	75	84.4	84.8	6.30	160.0	3.48	10	9	1		265.25	9.47	79
Bukit China, Malacca	89.3	72.6	80.9	92	69	82	75	84.2	83.9	0.96	24.4	0.25	8	6	3		240.85	8.60	71
Kluang, Johore	87.7	70.3	79.0	91	66	84	73	79.8	80.6	2.67	68.3	1.45	6	6	1	3	231.20	8.26	68
Bukit Lalang, Mersing, Johore	82.3	71.4	76.9	85	66	80	77	79.2	79.6	1.60	40.7	0.53	10	6			240.70	8.60	71
Alor Star, Kedah	92.6	68.8	80.6	97	65	87	73	83.1	84.0	0.33	8.4	0.31	2	1	2	1	260.90	9.32	78
Kota Bharu, Kelantan	85.2	68.5	76.9	87	65	81	75	80.1	81.8	3.75	95.3	2.45	4	4			249.65	8.92	75
Kuala Trengganu, Trengganu	83.8	68.9	76.3	87	66	78	75	80.4	81.4	3.79	96.3	2.74	5	4			255.80	9.14	76
HILL STATIONS.																			
Fraser's Hill, Pahang 4268 ft.	72.9	60.2	66.4	76	56	69	63	71.0	71.5	3.67	93.2	0.92	10	7	1	12	185.30	6.62	55
Pahang Highlands, Tanah Cameron	73.1	52.1	62.6	76	47	71	62	67.3	68.1	2.67	67.8	0.82	13	8		1	163.10	5.83	49
Kata, Pahang 4750 ft.																			
Cameron Highlands, Rhododendron Hill, Pahang 5120 ft.	73.3	57.5	65.4	78	53	69	60			2.53	64.3	0.63	12	8		1	184.75	6.60	55

Compiled from Returns supplied by the Meteorological Branch, Malaya.

THE Malayan Agricultural Journal.

MAY, 1933.

EDITORIAL

The Government Farm Fraser's Hill. Prior to 1929, the supply of fresh vegetables and milk on Fraser's Hill was limited; the vegetables were supplied from a small area in the neighbourhood of "Red-Cross" Bungalow, and adjoining this area a dairy herd was maintained, but the supply of milk was inadequate and working conditions were unsatisfactory.

It was evident that conditions justified the establishment of a farm operating on a larger scale, which would not only cater for the residential area on the hill, but would also provide useful information as to the prospects of supplying some of the needs of this country in the matter of hill produce such as milk, vegetables, poultry, eggs, meat, flowers, and fruit of a type likely to be in demand in the local markets.

The proposal for the new farm was submitted to Government by the Director of Agriculture in 1929, and in 1931 an officer of the Department of Agriculture was stationed at Fraser's Hill. Importation of pure-bred cattle and poultry was commenced, and the farm, situated at Jeriau, about 2½ miles north of Red Cross bungalow, began operation.

A vegetable garden, designed primarily with the object of meeting requirements on the Hill, was established near the new dairy farm and by 1932 was functioning satisfactorily. Surplus supplies have been disposed of in Kuala Lumpur and neighbouring markets. It is considered that there is a potential market for fresh vegetables of good quality once marketing and transport can be organised more efficiently, and the experience gained by the Department of Agriculture, as a result of the efforts on the Fraser's Hill farm should be of value to enquirers interested in this branch of agriculture.

It is evident that the most satisfactory results are obtained when the majority of the produce is planted so as to avoid the bad effects of very wet weather. Damage to seedlings during heavy rains and the ravages of certain insect pests and diseases, maintaining the fertility of the soil and ensuring a suitable crop rotation are the principal, purely agricultural, difficulties to be overcome.

The farm is fortunate in having available large supplies of cattle manure, so that it has not been found necessary to use artificial fertilisers except for experimental purposes. In this connection, it may be mentioned that the farm

is situated at a sufficient distance from the residential area to ensure that flies will not become a nuisance in the bungalows.

The vegetables which have shown promising results include beetroot, cabbage, carrots, green-peas, beans, leeks, lettuce, radish, asparagus, and spinach. Fresh vegetables are collected daily and are retailed at the milk depot in the residential area.

A fruit nursery has also been started and in addition to limes, bananas and papayas, an introduced raspberry and three types of strawberries are now established.

The excellent quality of the milk produced from the herd of Friesan cows at the dairy farm is much appreciated by the visitors to Fraser's Hill. Yields of milk have so far not proved high, but it is hoped to effect an improvement in this direction now that the pasturage areas have become established and suitable fodder is available. The milk is produced under most careful sanitary conditions, and the milk bottling-room is equipped with modern dairy appliances including a steam plant for sterilisation of utensils and a bottle filling apparatus.

With regard to poultry, it is considered that experiments in poultry farming in the hill country are likely to repay investigation, but much work remains to be done, before definite advice on this question can be given with authority. Expert advice on matters relating to poultry farming has not been readily available in Malaya in the past, but it is hoped that the efforts now in progress and future work contemplated on the hills as well as on the plains will, as far as resources permit, effect an improvement in this direction.

The account of the preliminary work in relation to dairy and poultry farming and production of marketable produce from the Malayan highlands published in this issue will, it is hoped, stimulate interest in what is a comparatively new branch of agricultural endeavour in Malaya.

The Oil Content of Malayan Groundnuts. In 1932, the net imports of groundnuts into Malaya amounted to 6,700 tons valued at \$723,306 and of groundnut oil 9,265 tons valued at \$2,195,486. The oil is used almost exclusively by the Chinese community as a cooking oil, and it seems evident that considerable scope exists for the extension of groundnut cultivation in Malaya, with the object of encouraging a local industry for the production of the oil.

During the Inter-Departmental Conference in Kuala Lumpur in 1932, it was decided that certain lines of work in connection with groundnuts should be pushed forward energetically, and in view of statements made locally that the oil content of Malayan groundnuts compares unfavourably with that of imported nuts, it was thought that an investigation of the question, by the Chemical Division of this Department, was desirable.

The results of the analyses, which are published in the article included in the present number, show that although the oil content of both local and imported kernels are of the same order, when calculated on a moisture-free basis, it is possible that, in some cases, a better recovery of oil is obtained from the imported kernels, which are dried before shipment, on account of their lower moisture content.

Manuring of Coconuts and Oil Palms. In March and June 1932, preliminary observations relating to manurial experiments on these two crops were published in this Journal. In this number of the Journal, results of the experiments, to date, are described and it is shown that while large, commercially remunerative returns have been secured from the use of phosphatic fertilisers on oil palms, yielding moderately or poorly and growing on quartzite hill or organic soils, no general conclusions can as yet be drawn from the manuring experiments carried out on coconut palms. On one coconut estate, however, where initial yields were low, an increase due to cultivation combined with clean weeding was recorded.

An encouraging fact which emerges from the results obtained with oil palms, is that manuring of the lower yielding areas is likely to be economic even with palm oil at the low price of £16 per ton, and it is considered likely that if, as is probable, rock phosphates are found to be suitable, the cost of manuring may be reduced still further.

Village Fairs. The article on village fairs which appears in this number of the Journal from the pen of Mr. L. D. Gammans, Assistant Director of Co-operation, provides an interesting discussion of a form of commercial activity which, as is pointed out in the article, exists in some form or another in almost all agricultural communities.

In efforts to broaden the economic basis of the country and to lessen dependence on imported foodstuffs the problem of disposing of increased quantities of locally produced commodities in competition with imported articles is not always easy of solution and as an aid to this end Village Fairs have a not inconsiderable potential importance.

In their simplest form such fairs are bartering grounds where one article is bartered for another. In slightly more complex form they constitute local trading centres where simple cash and credit transactions are carried out on a fixed day at regular intervals.

Born as they are of the exigencies of the moment their existence tends to be ephemeral; they have little permanence and their effectiveness waxes and wanes with the immediate circumstances prevailing in a locality; a slight change in economic conditions or in personnel may call one into existence or equally slight change terminate it.

It is plain that such fairs scattered over the country side can form useful local supplements to the large organised markets of the towns, and the possibility of encouraging them and at the same time imparting to them a degree of stability has engaged the attention of administrative, co-operative and agricultural officers for some time past. In the State of Kedah a Village Fair Committee has been lately appointed by the Government with the object of encouraging and supervising their organisation, and a scheme for small shows of produce in connection therewith has been devised.

Mr. Gammans gives details of a project for organising these fairs on a co-operative basis which has much to commend it. If, as Mr. Gammans suggests, the practice can be established of registering and operating these fairs as co-operative units and at the same time providing simple banking facilities in connection therewith, a notable step forward will have been achieved. Progress in connection with the movement will be watched with considerable interest.

THE GOVERNMENT FARM, FRASER'S HILL.

BY

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and

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Introductory.

The proposal to establish a dairy farm at Jeriau, Fraser's Hill, Pahang, originated as a result of a report submitted to Government by the Director of Agriculture dated 17th of August, 1929.

For some years a small dairy herd was maintained on the hill, in temporary wooden buildings, but the supply of milk was inadequate and working conditions unsatisfactory. It was considered advisable to select a site removed from the residential area, where a larger farm might be laid out on modern lines with sufficient space available for the necessary buildings, grazing paddocks, and pasturage. In addition, sites for a small poultry farm, vegetable and fruit areas, were envisaged.

The new farm commenced operations during the middle of 1931, when a herd of twenty-six Friesian cattle was imported from South Africa. At the same time a consignment of pure-bred fowls comprising the following breeds was received :—Rhode Island Red, Light Sussex and White Leghorns. Earlier in the year an officer of the Department was stationed at Fraser's Hill, preparatory to taking over the work of the farm when stock arrived. A new vegetable garden was opened at Jeriau, on land adjoining the dairy farm, with the object of ensuring an ample supply of fresh vegetables to meet the requirements of the hill station.

Although certain difficulties have been encountered, with close attention to detail these have been overcome. It is considered that the progress of the farm and vegetable garden for the year 1932, has been very satisfactory, particularly in respect of the latter half when large supplies of produce became available and were readily disposed of.

It is proposed, therefore, to publish a brief account of the farm and its activities to-date.

Situation and Climate.

The farm is situated about 2½ miles north-west of Red Cross House, at an elevation of 3,200 feet above sea-level. A jungle path connects the farm with the station at Fraser's Hill, which is approximately 1,000 feet higher than the farm.

The area felled and cleared, consists of hilly land with a clear stream of water, known as Sungei Jeriau, flowing through the valley. A considerable amount of soil levelling was necessary to secure a sufficient area for the farm buildings.

Meteorological observations are so far not recorded at the farm but those for Fraser's Hill may be taken as a guide. During 1932, rain fell on 238 days, giving a total rainfall of 114.94 inches. The driest month was July with a precipitation of 3.45 inches, and the wettest month was November with 15.52 inches. The mean maximum temperature was 72.3°F, the highest maximum was 79°F; the mean minimum was 61.9°F; and the lowest 55°F. The total sunshine recorded for the year was 1,738.30 hours, which gives an average of 4.76 hours sunshine per day. The farm at Jeriau, in addition to being lower than Fraser's Hill is considerably more sheltered.

An important advantage of the site selected is an adequate supply of pure stream water and accessibility to the residential area at Fraser's Hill. The risk of nuisance from flies was obviated by establishing the farm sufficiently distant from the bungalows.

Dairy Farm.

Permanent farm buildings, erected by the Public Works Department, including equipment and the installation of a water supply, were completed by July 1931. The buildings now in use are as follows:—byre for 32 cows, calf-pen, calving stable, bull stable, mule stable, isolation stable, food store, litter shed, dipping tank, and quarters for Farm Overseer, cattle attendants and coolies. Adjoining the main byre are separate rooms for the following purposes:—food mixing room, milk room, office, tool store and boiler house. Owing to the fact that granite was available, local stone was largely used in the construction of the farm buildings and paving the yards. The buildings and layout of the farm have been designed on modern lines, and represent approved ideas in dairy practice.

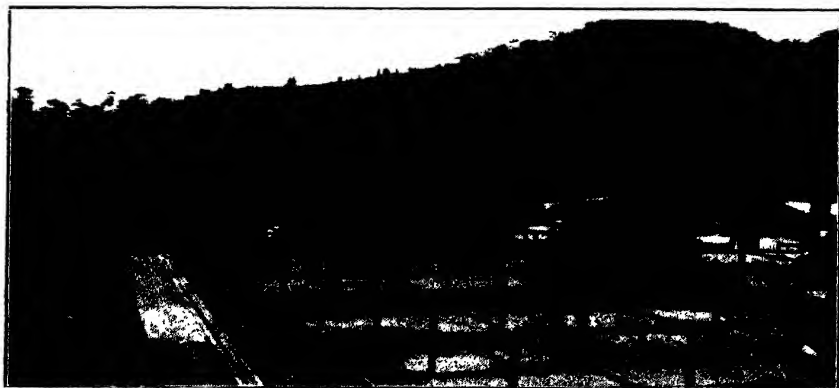
As already mentioned, the herd of pure-bred Friesian cattle was imported from South Africa. A pure-bred bull and twenty-five in-calf heifers arrived at Singapore from Durban in June 1931, through the agency of the Union of South Africa. The animals were quarantined for a period of two weeks at Fraser's Hill, and after inspection by the Government Veterinary Surgeon, Pahang, were transferred to the new farm. The animals arrived in good order and have proved well suited to conditions obtaining at Jeriau. In addition, a



The Dairy Farm.



Vegetable Area.



Poultry Runs.



The Friesian Bull.



Milking.



The Cow Byre.

number of Jersey cows and Jersey/Native half-bred heifers were taken over from the old farm formerly controlled by the Public Works Department.

At the close of the year 1932 the herd comprised the following stock :—

Breed.	Milch Cows.	Bull.	Heifer Calves.	Bull Calves.
Friesian ...	25	1	3	2
Jersey ...	4	—	1	1
Friesian/Jersey ...	—	—	1	—
Cross-bred ...	1	—	—	—
Totals ...	30	1	5	3

The young Jersey bull calf is being retained for stud purposes. Some thirty head of cattle were disposed of during the year 1932 including pure-bred Friesian calves born at Jeriau. A number of the latter were distributed for breeding purposes to various parts of Malaya. Eleven Friesian calves were purchased by a settler at Cameron Highlands.

Considerable attention has been given to the question of feeding the stock with the result that an economical and well balanced ration is now being employed. Details are as follows :—

Rations fed to stock at Jeriau Farm.

(a) Cows.

Maintenance Ration.

Rice bran ...	4 lbs.
Bengal gram ...	1 lb.
Maize ...	$\frac{1}{2}$ „
Coconut cake ...	$\frac{1}{2}$ „

6 lbs. concentrates.

Production Ration.

For each gallon of milk add :

Gingelly cake ...	3 lbs.
Bengal gram ...	$\frac{1}{2}$ lb.

The animals have free access to mineral salt licks fixed in the stalls.

(b) STUD BULL.

Rice bran	...	4 lbs.
Bengal gram	...	1 lb.
Maize meal	...	$\frac{1}{2}$ „
Coconut cake	...	$\frac{1}{2}$ „

6 lbs. concentrates.

A ration of 35 lbs. freshly cut grass is fed to the cows and stud bull daily.

Steps have been taken to feed calves with a ration as economical as possible. For this purpose separated milk, with the addition of $2\frac{1}{2}$ per cent. palm oil produced locally has been utilized. The condition of the calves has shown steady progress since this mixture has been fed.

The following is a complete ration programme for calves :—

(c) CALVES.

1 to 3 months old	—	milk 3 quarts.
3 months onwards	—	separated milk to which $2\frac{1}{2}$ per cent. of palm oil is added. Rice bran 3 parts. Bengal gram 1 part, coconut cake 1 part.

$2\frac{1}{2}$ lbs. of this mixture per calf up to 2 years,

3 lbs. of this mixture per calf from 2 to 3 years.

Grass is fed as required from 3 months onwards.

As European cattle are very liable to contract Red-water fever (*Piroplasma*) special attention is given to periodical spraying with cattle dips and the careful removal of ticks.

Milk yields of the Friesian herd have so far not proved high. Since the pasturage areas have become established every effort is made to provide the milking cows with sufficient supply of fodder to increase the milk yield.

The following figures show the records of milk yields of six Friesian cows in the dairy herd :—

Cow No.	Duration of Lactation Period.	Yield of Milk.
2	311 days	3,218 Imperial pints.
3	302 „	3,329 „ „
4	447 „	4,766 „ „
11	260 „	3,537 „ „
12	315 „	3,687 „ „
24	450 „	6,843 „ „

Gerber tests, to ascertain the percentage of butter fat of the milk produced by the herd are undertaken weekly. The average figure for the year 1932 was 4.3 per cent. butter fat.

The principal grass used for stall feeding purposes is Guinea grass (*Panicum maximum*). This grass has thrived exceedingly well on the slopes in the vicinity of the farm. Owing to intensive cutting, it is considered advisable to apply a dressing of manure at least once a year to ensure a high yield of suitable fodder. The following dressing of artificial fertilizers has been applied with satisfactory results:—2 cwt. Calcium cyanamide, 4 cwt. Basic slag, $\frac{1}{4}$ cwt. sulphate of Potash, per acre.

In addition, trials are being undertaken with the following grasses:—Kikuyu grass (*Pennisetum clandestinum*), Napier grass (*Pennisetum purpureum*) and *Stenotaphrum secundatum*.

The cows are milked at 4.30 a.m. and 12.30 p.m. The byre is thoroughly cleansed daily and all utensils are sterilized by steam immediately after milking. The milk room adjoins the byre and is equipped with modern dairy appliances including a milk cooler and cream separator. Every consideration is given to production of Grade A milk.

Two samples of milk from the herd, examined during March 1933, were reported upon as follows:—

Sample A.	24 Hrs.	48 Hrs.
Number of organisms per c.cm. developing on Agar at 37° C.	250	900
" <i>B. Coli</i> " present in " " <i>B. Coli</i> " absent from	1 cc. 1/10 cc.	1 cc. 1/10 cc.

Sample B.	24 Hrs.	48 Hrs.
Number of organisms per c.cm. developing on Agar at 37° C.	500	1,200
" <i>B. Coli</i> " present in " " <i>B. Coli</i> " absent from	1 cc. 1/10 cc.	1 cc. 1/10 cc.

A small quantity of cream is separated, when sufficient milk is available, and finds a ready sale. Dairy produce is transported by mules from the farm to the milk depot at Fraser's Hill, where it is sold to visitors or servants from the various bungalows. A steam plant for the sterilization of utensils, including milk bottles and cream cartons, is installed at the milk depot. A bottle filling apparatus is used to obviate contamination when handling the milk.

Poultry Farm.

The poultry farm comprises a flock of 30 pure-bred Rhode Island Red and 12 Light Sussex fowls. In addition there are 8 White Leghorns, 3 White Wyandottes, 12 cross-bred and 8 local fowls. The birds are housed in a series of four breeding pens and five laying pens; a further five poultry runs have been recently constructed for housing young stock. All birds are quarantined before being admitted to the farm as a precaution against contagious disease.

A wet mash is fed in the morning consisting of a ground mixture of 4 parts wheat, 2 parts maize, and 1 part whale meal not exceeding 4 ozs. per bird. Whole grain is fed at night. Green food such as cabbage and lettuce tops is provided and an adequate supply of ground oyster shell and fresh water is always available.

At the present time the output of eggs is insufficient to meet the demand from visitors to the hill, but every endeavour is being made to increase the egg-laying flock. Two incubators are now in use for this purpose. Settings of eggs are sold to applicants when available, but since the policy of the farm is to supply the requirements of visitors on the hill it has so far not been found possible to extend this branch of activity to any considerable extent. There is evidence however that poultry farming at such an altitude offers many possibilities for advancement in this country, but it is quite clear that further investigations are necessary before success in this direction may be attained. With regard to the actual weight of eggs laid by the various breeds, the White Leghorn has proved the most satisfactory, giving eggs averaging 2 ozs. in weight. Rhode Islands Reds are next in size with eggs weighing from $1\frac{1}{2}$ to $1\frac{3}{4}$ ozs.

Vegetable Garden.

The object of the vegetable garden at Jeriau is the production of fresh vegetables for consumption by visitors to the hill. Since, however, the demand fluctuates from time to time, surplus vegetables are disposed of in Kuala Lumpur and elsewhere. There is undoubtedly a large potential market for fresh vegetables of good quality, and it is considered that the experience gained to-date will be of value to those interested in this branch of horticulture.

With regard to the actual altitude at Jeriau (3,200 feet), it appears from information so far available to be a very suitable elevation for the production of European vegetables. Whilst the temperature is sufficiently low to suit the requirements of the majority of such vegetables, growth is comparatively rapid, resulting in the production of large crops of good quality.

The Assistants Chemist, Soils Division, comments as follows regarding the soil at Fraser's Hill:—

“The soils of the area are best described as sandy clay granites having a clay content of about thirty per cent. with the majority of the balance made up of coarse sand and gravel. They should drain fairly readily with such a texture.

They are generally speaking very poor, due in large measure to the high percentage of sand. Chemical analysis shows them to be of an average composition so that it may be assumed that the poorness is also due, to some extent, to the fact that its constituents are not broken down into an available form".

The site of the vegetable garden is situated on a moderately steep slope which permits of terracing throughout the whole of the area. Excellent drainage is obtained in such a situation. To save the considerable amount of labour involved in carrying water from the stream, a system of pipe supply has been installed. This was undertaken at a small cost owing to it being possible to dam a stream at a short distance away in an adjoining ravine. It must be emphasised that, since the most satisfactory results are obtained from vegetables during dry weather, a convenient supply of water is essential, otherwise labour costs are high.

For the purpose of maintaining the terraces in proper order and preventing slips during wet weather all banks are planted with Carpet grass (*Axonopus compressus*). This grass has an excellent binding effect on the soil and may be kept in check without excessive labour.

It is not possible in this article to record in detail the procedure necessary to raise from seed, transplant where necessary and cultivate the various vegetables in use. The principal difficulties encountered are high rainfall during certain periods of the year necessitating protection of seedling plants, insect pests, maintaining the fertility of the soil and ensuring a suitable crop rotation.

Owing to large supplies of cattle manure being available from the dairy farm it has not been found necessary to use artificial fertilizers.

The following manurial programme is proposed as a general guide :

Manure.	Period of application.	Quantity.	Area.
Cattle or other well rotted humus ...	alternate years	50 lbs.	100 sq. feet.
Artificial fertilizers ...	yearly	1 - 2 lbs.	- do -
Air-slaked burnt lime ...	alternate years	5 lbs.	- do -

It may be noted that by the use of basic fertilizers *e.g.*, Calcium cyanamide and Basic slag the addition of further supply of lime is unnecessary.

With regard to the actual manurial requirement, the common types of vegetables may be conveniently grouped as shown below.

Group.	Crop.	Manure.
A	Beans, peas, potatoes	Phosphoric acid and Potash
B	Cabbage and other leaf crops	Nitrogen and Phosphoric acid
C	Beet, carrot, parsnip, radish and other root crops	Nitrogen and Potash
D	Onion, leek, turnip, celery	Nitrogen, Phosphoric acid and Potash

In the absence of adequate supplies of cattle manure, or on land which has become highly acid by continuous applications of organic manure, the following programme of manuring is suggested for general use:—

Group.	Fertilizer.	Quantity per acre.
A	Rock phosphate	4½ cwts.
	Sulphate of potash	2½ „
B	Calcium cyanamide	4 cwts.
	Rock phosphate	3 „
C	Calcium cyanamide	5 cwts.
	Sulphate of potash	2 „
D	Calcium cyanamide	3½ cwts.
	Rock phosphate	2½ „
	Sulphate of potash	1 „

Owing to the short period during which vegetables have been growing at Jeriau it is as yet too early to differentiate as to the most suitable varieties for cultivation.

The following table records results of the more important vegetables that have been grown with success. A standard area of land of 100 sq. feet is taken for each crop for recording purposes. In calculating returns for larger areas a reduction in crop of 15 to 20 per cent. must be allowed on account of paths between the beds.

Vegetable.	Period of growth.	Yield per 100 square feet. lbs.
Beetroot ...	3 months	64
Cabbage ...	14 weeks	60
Carrot ...	3 months	58
Cucumber	10 weeks	70
French Bean ...	10 „	35
Green Pea ...	12 „	15
Kale ...	10 „	40
Leek ...	5 months	25
Lettuce ...	10 weeks	42
Potato , ...	3—4 months	28
Radish ...	1 month	20
Tomato ...	14 weeks	76

Other vegetables that show promising results are asparagus, lima bean, khol rabi and spinach.

Inter-cropping is undertaken where possible; by this means two crops of different maturation periods occupy the land. Fresh vegetables are collected daily and transported to the milk depot for sale to visitors. Any surplus available is despatched to Kuala Lumpur.

Fruit Area.

Steady progress has been made in the opening up of a small area north-east of the vegetable garden for the purpose of growing fruit. Limes, bananas and papayas have been established. An introduced raspberry (*Rubus lasiocarpus*) thrives exceedingly well and gives reason to expect that other fruits of this genus might be cultivated with success. In the vegetable area, three types

of strawberries are being grown *e.g.* Royal Sovereign, raised from English seed; a variety introduced from the Philippine Islands, and a variety from Hakgala, Ceylon. Two beds of the Philippine strawberry provided large crops of fruit, during the latter part of the year, which were readily saleable. After fruiting, it is necessary to cut the plants back to within an inch or so of the crown. Rhubarb is also very successful, plants being easily raised from imported seed, and crops throughout the year.

In conclusion it may be stated that there is considerable scope for further investigation as to suitable vegetables, fruits and flowers for this altitude. Owing however to strict economy, experiments in this direction are not at present possible since the farm and gardens are run as a commercial undertaking.

MANURIAL EXPERIMENTS ON COCONUTS AND OIL PALMS.

BY

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and

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A. Coconuts.

In this Journal for March 1932 (page 105) an account was given of the layout and conduct of standardised experiments on the manuring of coconuts carried out by the Department of Agriculture on seven estates with the co-operation of the managers. Briefly, on each estate there are four experimental blocks of 64 palms divided each into four plots of 16 palms. Half of the plots are under a cover-crop or grass and half are bare. The vegetation on one of the covered plots in each block is slashed every three months and allowed to lie on the surface, on the other it is turned in to a depth of 7 inches every six months; one of the bare plots in each block is cultivated to a depth of 7 inches every year and the other is left undisturbed except for weeding operations. Each plot is further sub-divided into four plots of four trees each to which are applied (a) a complete mixture (NPK); (b) lime (L.); (c) lime and a complete mixture (L.NPK); and (d) nothing (Control—C). Undue borrowing of manures by straying roots is avoided by drains and guard rows. There has been insufficient response to manuring to test the efficacy of these precautions for coconuts, but they have been proved to be efficacious in the case of oil palms with root systems at least as extensive.

The fertiliser mixture employed is as follows:—

Whale Guano Compound	...	2½ lbs. per tree.
Steamed Bone Meal	...	4 " " "
Muriate of Potash	...	1½ " " "

This mixture supplies Nitrogen 12, Phosphoric acid (P_2O_5) 44 and Potash 36 lbs. per acre.

Lime was applied at the rate of 10 piculs (approximately 12 cwts.) per acre.

Type of soil, age and other particulars of the trees employed are given in Table B. Three applications of manures and lime have been made on Estate A in August of 1930, 1931 and 1932, and two applications in all other cases in the first quarters of 1931 and 1932.

As nuts take approximately twelve months to mature it was not expected that any effect of manures or surface treatments would be exhibited during the first year. Records for this period however should be useful as uniformity trials. Means obtained from these records are given in Table C.

Inspection of these figures show that uniformity is satisfactory with the possible exception of Estate "B", as far as mean yields are concerned; turning to the figures given in Table A which show the minimum percentage differences which can be regarded with some certainty as due to the treatment or manure employed and not to chance, it is seen that increases large enough to be economic should be discovered for "treatments" on Estates A, D and E, and for manures on Estates A, D and G. Owing to relatively large inherent variation on Estates B, F and G, "treatments" in these cases would need to cause large differences of yield if reliance is to be placed on one year's results; when several years' yields are available the error should materially be reduced.

Mean yields for 1932, when manures and treatments may be presumed to have had opportunities of influencing harvest, are given in Table D.

The only changes of any magnitude are to be found in Estates B, D and F, and only these results have been statistically analysed.

Results of statistical analysis for 1932 are:—

		Minimum Difference for Significance between any Pair of 'Treatments'	Minimum Increase over Control for Significance
		per cent.	per cent.
Estate B	...	31.4	28.8
D	...	16.9	15.0
F	...	29.8	16.7

From this it follows that while no manurial increase is "significant", the result of cultivation with clean weeding has been definitely better than any other treatment on Estate B, and better than slashing of cover on Estate D; the same treatment just misses significance on Estate F*.

A further test of the results may be made by taking into account the 1931 results and considering the changes from 1931 to 1932. If this is done there is enhancement of the difference between cultivation of bare surface and cover buried on Estate F and of increase of manured over control plots on Estate B. Analysis by Sanders' method of co-variance shows the former to be just significant while the latter is not, due mainly to the enormous variation in 1931 on that Estate.

All records discussed above are of numbers of nuts, it is of course realised that manures or treatments may act also by increasing nut size or copra content.

* The "Z" values confirm these deductions,

The actual preparation of copra from a small number of nuts from a large number of plots presents great difficulties, but the Assistant Chemist for Copra Research (Mr. F. C. Cooke) has shown that there is a remarkably close relationship between weight of husked nut and meat content; determinations of weights of husked nuts have been made once in 1932 and will be repeated half-yearly. So far no economic or significant differences of nut size have emerged.

Conclusions.

Experimental error, although large, is generally within the limits required for the testing of the large increases which would be necessary for manuring to be economic.

The one outstanding fact of the experiments has been the increase due to cultivation on Estate B, where initial yields were low; apart from this no general conclusions can be drawn nor advice for manuring given from results up to the end of 1932.

Records will be taken during 1933 and treatments continued but no manures or lime will be applied, since it is possible that results may appear later.

TABLE A.

	Minimum difference between any pair of "treatments" required for significance, per cent.	Minimum increase over control required for significance in the case of manures, per cent.
A	17.0	12.8
B	64.0	49.0
D	19.6	9.1
E	18.9	10.7
F	31.6	16.9
G	46.5	18.5

TABLE B.

Estate	Locality	Age of palms at commencement of experiment	Type of soil	Treatment before experiment started	Type of cover employed in experiment
A	Banting	21 years	Alluvial clay loam	Clean weeded	Grass and weeds
B	Province Wellesley —North	Unknown, very old	Sandy soil over white silt	Under grass	Grass
C	Province Wellesley —South	20 years	Heavy clay	Under <i>Centrosema pubescens</i> and grass ploughed in at intervals	<i>Centrosema</i> and grass
D	Krian District	20 years	Friable clay loam	Clean weeded	<i>Centrosema</i> and <i>Mikania scandens</i>
E	Bagan Datoh	20 years	Heavy clay	Grass, <i>Centrosema</i> and Fern	Grass, <i>Centrosema</i> and Fern
F	Sabak Bernam	17 years	Very heavy clay	Leguminous cover and weeds. Block 4 <i>Centrosema</i> and Grass	Grass and leguminous covers Blocks 1—3, <i>Centrosema</i> in Block 4.
G	Sepang	10—11 years	Peat overlying heavy clay	3 Blocks under weeds and fern. 1 Block under <i>Mikania scandens</i>	3 Blocks under weeds and fern. 1 Block under <i>Mikania scandens</i>

TABLE C.
Mean Results for First Year.

Estate	Period	Yield of nuts per tree	SURFACE TREATMENTS				MANURES			
			Cover slashed	Cover buried	Clean cultivated	Clean not cultivated	As percentages of general mean			
A	July 1930 to June 1931	57.00	95.7	105.2	103.9	95.3	101.9	103.4	91.0	106.3
B	1931	15.75	87.2	118.2	97.7	96.9	86.6	98.1	87.7	127.6
C*	—	—	—	—	—	—	—	—	—	—
D	1931	76.00	93.2	105.2	101.3	100.1	96.4	99.5	98.5	105.5
E	"	80.75	103.6	97.6	101.1	98.1	97.4	104.0	96.7	101.0
F	"	51.75	99.4	106.5	96.1	98.0	101.5	92.6	102.2	103.7
G	"	50.75	103.5	100.2	96.1	102.3	101.5	99.6	103.3	96.5

* Yields from Estate C were not available for twelve months.

TABLE D.
Mean Results for 1932.

Estate	Mean yield of nuts per tree	SURFACE TREATMENTS				MANURES			
		Cover slashed	Cover buried	Clean cultivated	Clean not cultivated	NPK	LNPK	Lime	Control
A	46.62	95.5	99.3	102.1	103.2	92.0	104.0	102.3	101.7
B	22.37	86.5	87.1	132.8	93.7	96.7	111.3	91.4	100.5
C	88.73	92.3	98.0	103.5	106.2	104.2	92.4	101.4	102.0
D	65.19	84.9	101.1	113.5	100.5	89.6	99.3	104.0	107.0
E	64.69	100.1	100.6	102.4	96.8	98.2	99.0	93.1	109.7
F	45.85	98.7	88.5	117.5	95.3	96.8	102.2	106.8	94.2
G	55.22	96.9	109.8	99.7	93.6	96.5	101.0	100.6	101.9

B. Oil Palms.

In this Journal for March (page 110) and June (page 304) 1932, accounts were given of the lay-out and yield records of standardised manurial experiments on oil palms.

On two estates and at the Government Experimental Plantation, Serdang, preliminary records for $\frac{1}{2}$ — $1\frac{1}{2}$ years have been taken and manures applied to plots of 10 trees each of oil palms in bearing.

At Serdang, there are three replications of each treatment arranged in three blocks, and on the estates five or six replications arranged in two blocks.

Manures have been applied twice yearly and from July 1930 to July 1931 consisted of :—

Sulphate of ammonia (20 per cent. N) at the rate of 1 lb. per palm per annum "N".

Superphosphate (18—20 per cent. P_2O_5) at the rate of 4 lbs per palm per annum "P".

Sulphate of potash (48 per cent. K_2O) at the rate of 1 lb per palm per annum "K".

Sulphate of magnesia (16 per cent. MgO) at the rate of $1\frac{1}{2}$ lbs. per palm per annum "Mg".

These substances have been applied alone or in combination to give mixtures designated later as NPK, PK, PK Mg, etc. In one experiment lime was applied to two plots, but gave no perceptible increases.

In 1932 basic slag was substituted for superphosphate.

Owing to the presence of supplies not yet in bearing on certain of the plots, it has been necessary to express yields per mature tree and not per plot.

Results in pounds of fruit bunch per mature tree are given in Table E. From these figures it will be seen that the addition of magnesia has had no material effect, accordingly, in Table F where results are expressed as percentages of the general mean for each year, the results for each manurial treatment with addition of magnesia have been merged into those for the same treatment without magnesia.

It was originally intended to have 20-tree plots but yield records (fortunately taken for individual trees) showed that the experimental error due to inherent variation of the palms was so great that 20-tree plots would give an insufficient number of replications for the desired degree of accuracy. Before the first application of manures in 1930 the 20-tree plots were divided into 10-tree plots with a guard-tree between, an extra tree being taken into every other plot. For this reason, yields in 1929 and the first half of 1930 are not exactly comparable with those of subsequent years, but for practical purposes comparison may be made since all that has happened is the substitution of one tree out of ten in half the plots comprising any given treatment and the differences found as a result of manuring transcend any error which could arise as a result of this substitution.

One of the Blocks on Estate B was taken into the experiment in July 1930, hence no 1929 yields are given for this Estate.

There were two other experimental blocks on Estate B on sandy quartzite soil, unfortunately one suffered somewhat severely from disease and the results (which show a decided increase following manuring) cannot be accepted as sufficiently reliable. The other block (three replications) has given the following results in pounds per tree :—

		1931	1932
NPK	...	195	196
PK	...	168	195
P	...	170	178
Control	...	175	197

It is clear that in view of the small number of replications, none of these differences have significance; the fact that such differences as exist are far smaller than those on the other experimental areas may be due to the fact that the field in which these plots are situated received a dressing of local phosphate at the rate of approximately half a ton per acre, some years ago.

Unfortunately the Serdang results suffer from the presence in each treatment of one low-yielding plot in which the trees are becoming progressively worse, due most probably to the approach to the surface of the sub-soil, a very fine compact white sand. As a result, experimental error is great and increasing. If the poorest plot is omitted from each treatment, leaving two replications only, mean yields become in pounds per palm :

		NPK	PK	P	Control
1929	...	228	195	233	208
1930	...	175	218	202	195
1931	...	233	290	233	207
1932	...	279	293	249	232

and still no significant increases are shown.

This experiment was extended in 1932 by duplicating the existing blocks but the extension has not been sufficiently long in operation to render the results of value.

Taking the stand of 55 trees per acre and conventional factors of 60 per cent. of weight of bunch as stripped fruit and 25 per cent. of stripped fruit as oil, it appears that control yields, taking the means of 1931 and 1932 of oil in pounds per acre per annum, were approximately Serdang 1550, Estate A 1440, Estate B 872. Preliminary records of 1929 and 1930 show that the manured plots were not of inherently greater yield capacity than the control, but rather the reverse, except in the case of the NPK plots of Estate B, so that every confidence may be placed in the results of the statistical analysis which shows that real gains have resulted from manuring with phosphate manures on Estates A and B, while no further increases have resulted from addition of potash, nitrogen or magnesia.

The lack of response at Serdang may be due to soil peculiarities, or the fact that with a given type of palm a natural yield of say 1500 lbs. of oil at 10—12 years cannot be increased by manuring.

On the commercial side, manuring has been successful on Estates A and B. Taking the application as $1\frac{1}{2}$ cwts. of superphosphate or basic slag per acre at \$3/- per cwt. and allowing for cost of application, the return, excluding harvesting, manufacture and handling, with oil at £ 16 per ton, would be approximately £4 per acre for Estate A and £6.10.0 per acre on Estate B; as stated in Table E the experimental areas on the former Estate are on undulating quartzite soil and on the latter on organic (commonly known as "peaty") soil.

The cost of manure may be further reduced if rock phosphates prove suitable and judging from the results of pot culture experiments with other crops, such as maize or gingelly, there is every reason to suppose that they will prove suitable. A new experiment has been started at Serdang on soil similar to that of Estate A, to compare rock phosphate with basic slag.

In view of the fact that response has not been obtained at Serdang nor on the relatively high yielding area on Estate B which had been previously manured, manuring can only definitely be recommended on organic or quartzite hill or undulating soils for areas yielding less than—say—1300 lbs. of oil per acre at 10—12 years. On other soils and on higher yielding areas, it is recommended that simple experiments be conducted on—say—two or three, 5 or 10 acre blocks using the remainder of the field or fields as control. Records should be taken for six months before manuring.

In order to ascertain the frequency with which applications must be made it is proposed to withhold manures during 1933 but to continue records.

Summary.

An account is given of manuring experiments on oil palms in bearing.

It is shown that large and commercially remunerative returns have been secured from the use of phosphatic fertilisers, on palms of medium or poor yield, on quartzite hill and on organic soils.

A warning is given that good yielding areas may not respond to manuring and simple experiments are suggested before large scale manuring is undertaken.

The authors desire to express their thanks to the Managers and Agents of the coconut and oil palm Estates, on which experiments have been conducted, for their assistance, and to Mr. B. Bunting, Agriculturist, for much help and valuable criticism.

TABLE E.

Mean Yield in Pounds of Fruit in Bunch per Mature Tree*

SERDANG. Quartzite Valley Soil. Palms Planted November 1924.

	No. of Mature Trees	1929	1930	1931	1932
NPK ...	30	195	146	179	224
PK ...	30	185	191	237	235
P ...	30	209	177	182	195
Control ...	30	187	170	158	204
Mean of all Plots ...		194.0	171.0	189.0	214.5

ESTATE A. Quartzite Hill Soil. Palms Planted 1922.

	No. of Mature Trees	1929	1930	1931	1932
NPK ...	36	100)	144)	221)	254)
" + Mg ...	17	102) 101	157) 148	259) 234	268) 259
PK ...	40	77)	127)	199)	243)
" + Mg ...	19	76) 77	100) 118	200) 199	232) 240
P ...	37	82)	153)	243)	256)
" + Mg ...	17	93) 86	128) 161	234) 240	220) 246
Control ...	53	90	177	167	181
Mean of all Plots ...		88.5	151.1	209.6	231.3

ESTATE B. Organic Soil. Palms Planted 1918.

	No. of Mature	1930		1931		1932
		Block I	Block II (6 Months only)	Block I	Block II	Block I and II
NPK	27	118	41	209	127)	230)
" + Mg	17	160	51	146	143) 167	244) 235
PK	27	99	13	210	86)	211)
" + Mg	14	122	47	277	149) 186	221) 221
P	25	66	42	222	255)	230)
" + Mg	19	53	46	200	210) 222	236) 232
Control	48	90	45	110	92 99	113
Mean of all Plots					168.5	200.3

* Figures are given to the nearest unit for clarity. For analysis, approximation to the first place of decimals was employed.

TABLE F.
Yields Expressed as Percentages of General Means.
SERDANG.

	1929	1930	1931	1932
NPK ...	100.5	75.3	92.3	104.4
PK ...	95.4	98.5	122.2	109.6
P ...	107.7	91.2	93.8	90.9
Control ...	96.4	87.6	81.4	95.1
Increase over control required for significance ...	27	44	82	per cent. 74
Difference between any two treatments required for significance...	35	57	105	97

ESTATE A.

	1929	1930	1931	1932
NPK ...	113.6	98.2	11.4	111.9
PK ...	87.4	77.8	95.0	103.7
P ...	97.2	106.8	114.4	106.3
Control ...	101.9	117.4	79.2	78.4
Increase over control required for significance ...		29.	18	per cent. 19
Difference between any two treatments required for significance...		35	22	24

ESTATE B.

	1931	1932
NPK ...	99.1	117.3
PK ...	110.4	110.3
P ...	131.8	115.8
Control ...	58.8	56.4
Increase over control required for significance ...	24	per cent. 14
Difference between any two treatments required for significance ...	30	17

THE OIL CONTENT OF MALAYAN GROUNDNUTS.

BY
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Introductory.

As a result of the recently imposed duties on all oils and fats for edible purposes, attention has been drawn to the possibilities of extending the cultivation of groundnuts with the object of encouraging a local industry for the production of the oil.

Large quantities of both groundnuts and groundnut oil are imported annually into Malaya, the bulk of these commodities being retained for local consumption.

The trade returns for these products for the years 1931 and 1932 were as follows :—

Year	Groundnuts		Groundnut oil	
	Net Imports	Value	Net Imports	Value
	Tons	\$	Tons	\$
1931	6,781	677,219	13,291	2,967,789
1932	6,700	723,306	9,265	2,195,486

In this connection it is of interest to note that in the case of the 1931 imports more than 90 per cent. of the groundnuts were imported from Java, while in the case of the oil, 85 per cent. originated from China and 14 per cent. from Java. The details of countries of origin for 1932 imports are not yet available.

The figures for the trade returns show therefore that there should be little difficulty in disposing of the crop locally, either as kernels for edible purposes or for expression of oil. As is well-known, groundnut oil is used almost exclusively by the Chinese community as a cooking oil, while the cake remaining after expression of the oil constitutes a valuable feeding stuff and should find a ready market.

As regards the utilisation of the crop for oil expression, however, statements have been made that the local nut compares unfavourably with the imported nut in oil content, the recovery of oil being stated to be as much as 5 per cent. greater in some cases for the imported compared with the local nut.

In view therefore of the possibilities of the crop, especially for cultivation by the small-holder, a series of analyses of nuts from different sources has been carried out in order to ascertain the extent of the variation in the oil content.

Collection and Analysis of Samples.

When discussing the oil content of groundnuts a distinction must be drawn between the undecorticated, or whole, nuts and the kernels. The latter are also referred to as decorticated nuts.

Since, however, groundnuts imported into Malaya are invariably decorticated, thereby saving freight charges, the comparative analyses were confined to the decorticated nuts or kernels proper.

It will be realised that when comparing the oil contents of kernels from different sources the figures must all be calculated to the same moisture content, and in this instance the moisture-free basis has been chosen. Although such a basis is theoretical, since the kernels, even though dried to constant air-dry weight, still contain a small percentage of moisture, a moisture-free basis is the most convenient to adopt for purposes of comparison.

Four samples of locally cultivated nuts were obtained from different parts of the country, also a similar number of samples of imported kernels. As regards the latter, three originated from Java, the remaining one from Coromandel, South India. As is well-known there are large exports of groundnuts from India to the European markets.

In addition to the oil content, determinations were also made of the average size of kernel in order to ascertain the difference existing between the local and imported varieties in this respect.

Results of Analysis.

The results of analysis of the various samples which are shown in Table I, indicate that while the Java kernel is larger in size than the local kernel, the figures for all the oil contents fall within the same range. There is no marked difference in favour of the Java kernel in respect of oil content, in fact the figures are slightly lower than those for the local kernels.

In this connection it is interesting to note that the sample of Coromandel kernels, although smaller in size than the average of either those imported from Java or cultivated locally, is richest in oil content.

General Considerations on Expression of Groundnut Oil.

Although the above figures indicate that the oil contents of both local and imported kernels are of the same order, when calculated on a moisture-free basis, it is possible that in some cases a better recovery of oil is obtained when pressing the imported kernels on account of their lower moisture content. This is due to the necessity of adequate drying before shipment in order to prevent development of mould with consequent reduction of oil content and deterioration in quality of oil.

Results of analysis show that the moisture content of freshly harvested groundnut kernels may be as high as 42 per cent. and, although the kernels can

be shelled without being damaged when the moisture content is still 20 to 25 per cent., it will be realised that the latter figures are considerably in excess of those quoted in the table.

Further, it is well known that when pressing groundnuts there is a tendency for the material to spue owing to the soft texture of the kernel. This tendency, which is especially noticeable when pressing the meal cold for the recovery of the first quality oil, would become more marked if fresh kernels, which had been insufficiently dried, were treated. In order to overcome spueing, and to ensure the expression of a clear oil, a small proportion of the husk is sometimes incorporated with the kernels during grinding, the fragments of husk acting as a binding material to the soft meal.

Also, it will be found that when the meal has a tendency to spue, in addition to the loss of oil entailed by an increased amount of sludge, the meal also tends to retain an increased amount of oil, so that the actual recovery of oil is diminished owing to both causes.

It will be realised therefore that the moisture content of the kernel is important from the point of view both of satisfactory expression of oil and of recovery of oil. As regards the latter point, the figures in the following table showing the progressive decrease of oil content with increase of moisture content may be of interest.

Moisture per cent.	Oil per cent.
Nil	50.0
4	48.0
8	46.0
12	44.0
16	42.0
20	40.0

Assuming an average of 50 per cent. of oil for the moisture-free kernel, it will be seen that there is a decrease of 2 per cent. in the oil content for an increase of 4 per cent. in the moisture content.

Unless therefore the kernels are adequately dried before expression, a diminished oil recovery, compared with imported kernels, will result.

Owing to the protection offered by the shell to the soft moist kernel, the nuts when first harvested should be dried in the shell. Drying should continue until the nuts cease to lose weight, after which the nuts should be shelled, the kernels being further dried for a few days to ensure that the process is complete.

Oil Content of Whole Nuts.

Although no comparison could be made of the proportion of shell to kernel in the case of the imported nuts it may be of interest to record the figures for the local produce, since in those cases whole nuts were received for analysis.

The results, which are shown in Table II, are based on the samples as received, the figures for the oil content being abstracted from the previous table.

TABLE I.
Variations in Size and Oil Content of Groundnut Kernels.

	LOCAL				JAVA			INDIAN
	Sample No. 1	Sample No. 2	Sample No. 3	Sample No. 4	Sample No. 1	Sample No. 2	Sample No. 3	
Average weight of kernel ...	0.31 gms.	0.46 gms.	0.50 gms.	0.58 gms.	0.70 gms.	0.70 gms.	0.51 gms.	0.40 gms.
Moisture (loss at 100°C) ...	per cent.	per cent.	per cent.	per cent.	per cent.	per cent.	per cent.	per cent.
Oil (petroleum ether extract)	7.4	8.0	5.9	6.5	7.6	7.1	6.4	6.2
Residue (by difference) ...	47.5	46.1	45.4	47.3	45.2	46.3	46.3	48.8
	45.1	45.9	48.7	46.2	47.2	46.6	47.3	45.0
	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Oil (on moisture-free basis)	51.3	50.1	48.3	50.6	48.9	49.9	49.5	52.0

TABLE II.
Results of Analysis of Local Groundnuts.

	Sample No. 1	Sample No. 2	Sample No. 3.	Sample No. 4
	per cent.	per cent.	per cent.	per cent.
Proportion of shell ...	35.0	32.5	27.0	24.5
Proportion of kernel ...	65.0	67.5	73.0	75.5
	<u>100.0</u>	<u>100.0</u>	<u>100.0</u>	<u>100.0</u>
Oil content of kernel ...	47.5	46.1	45.4	47.3
Oil content of nut ...	30.9	31.1	33.1	35.8

The results indicate therefore that the proportion of kernel to whole nut varies from approximately 65 to 75 per cent., the oil content of the nut from approximately 31 to 36 per cent.

Wide variations are to be expected in the case of the nut owing to the variation in development of kernel, the latter being dependent on other factors, for example, soil and cultural conditions, and freedom of the plant from pests and diseases.

Conclusions.

The results indicate that, although the imported groundnut kernel is larger than the local kernel, the increased size cannot be correlated with a higher oil content.

The oil content figure, calculated on a moisture-free basis, approximates to 50 per cent., which corresponds to approximately 46.5 per cent. on a 7 per cent. moisture basis. The latter figure would appear to represent the average moisture content of air-dry kernels.

It is possible that the lower oil recovery found in some cases for locally grown nuts is due to insufficient drying.

THE VILLAGE FAIR.

A Co-operative Experiment.

BY

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The village fair as a means of exchanging the surplus produce of agriculturists has existed from the dawn of history. It is found in almost every country of the world in some form or other. In Malaya under the name of "pekan sa-hari" (one-day market) it has been found in a simple form in many parts of the country. During the past fifteen years or so, the rapid spread of rubber growing amongst Malay small-holders has tended to destroy the village fairs in many parts of the country. The large profits which resulted from rubber growing, discouraged the small-holder from planting food crops which normally form the basis of a village fair. It was easier and more profitable to concentrate on rubber, and, from the proceeds, purchase the foodstuffs required from Chinese market-gardeners and from the village shop. The catastrophic fall in the price of rubber — probably the biggest percentage decline in the price of any primary commodity (1925: 32d. per lb., 1932: 2d. per lb.) — has demonstrated the danger of the peasantry, and incidentally the revenue of the country, being dependent upon the price of a commodity subject to such wild fluctuations. During the past year, as a result of economic pressure and strenuous propaganda by the Government Departments concerned, there has been a growing tendency for Malay small-holders to grow food crops for their own consumption. This has been done partly by the alienation of new areas, including Government Reserves on a temporary occupation licence, and partly by cutting down small areas of rubber in those districts where no State land was available. A special cinema film, entitled "Food First", stressing the desirability of each small-holder growing sufficient food-stuffs for his own use, has been prepared by the Co-operative Societies Department and is being exhibited by the Rural Lecture Caravan which is maintained jointly by the Agricultural Department, the Rubber Research Institute and the Co-operative Societies Department.

This increased growing of foodstuffs has been largely responsible for the revival of village fairs in all parts of the country. Without some such medium of exchange, it would be difficult, if not impossible, for the peasant to obtain a fair price, or even any price at all, for his surplus produce. The fairs have started in a simple way. Generally speaking, the local Penghulu with the assistance and encouragement of the District Officer has persuaded his people to put up small stalls, made of jungle timber and roofed with attap, on a piece of waste land at some convenient centre. A day is fixed for the fair. Peasants bring in their surplus produce and gradually a simple trading centre has grown up.

In course of time, certain defects have revealed themselves. Fairs were often started without sufficient attention being paid to the suitability of the site as a marketing centre with the result that they have quickly died. Questions of supervision and cleanliness have arisen. In many places the fairs have been swamped by sellers of other nationalities, or by small-holders from other parts of the State, thus vitiating the main principle of the fair as a medium of disposing of the surplus produce of a particular place. It was felt that some simple form of organisation was desirable if the best results were to be obtained.

At the request of several District Officers, the Co-operative Societies Department has endeavoured to find a solution. It was decided to recommend that the fairs should be registered as Co-operative Societies, and simple by-laws were drawn up. There are certain obvious advantages in registering these organisations under the Co-operative Law. The fair becomes a recognised, registered body controlled by an elected Committee which is responsible to the District Officer for its proper supervision, control and cleanliness. Membership of the fair is restricted to small-holders living in its area of operations. Outsiders are not prohibited from selling, but they are subject to such restrictions as the Committee of the fair may wish to impose.

The by-laws make provision whereby members can open simple deposit accounts with the fair, and bank a part of the proceeds of their sales. This money can be withdrawn as and when required, or can be accumulated for the payment of land rents. It is somewhat curious to note that, in some places, the idea of a deposit to assist the raiats to pay land rent is one of the features of the fair which makes a special appeal to them. When rubber stood at boom prices, it was generally possible for the small-holder to pay the whole of his year's rent from the proceeds of one sale of rubber. The position is of course different now. At present prices, it means that the money must be saved by putting aside a definite percentage of a number of sales. The raiat is not used to the idea and finds considerable difficulty in adjusting his habits of life accordingly.

Land rent is the only direct taxation paid by the peasant, and a small-holder with an average holding should not find it difficult to pay it provided that he is capable of adjusting himself to the idea of collecting it in instalments. The deposit accounts in the co-operative fairs should be of considerable assistance to him in this direction.

The provision of simple banking facilities in an organisation of this sort should also tend towards a better appreciation of the use of money. Merely to increase the income of a peasant by means of better agriculture or better marketing of produce is not all that is required. The main criterion is what he does with the extra money which has come to him. There is no gain in helping a man to make an additional \$2 at a weekly fair, if the extra amount obtained is to be immediately frittered away in the local coffee shop or if he is to idle about, doing no work, until it is all spent.

Another advantage of regulating a fair as a co-operative society is that it should tend to inculcate a corporate spirit amongst its members. One of the great difficulties in starting more advanced types of co-operative societies such as Credit Societies, Marketing Societies, Village Shops, etc., is that the idea of working together, at any rate under modern conditions, is a novel one. Mutual suspicions have to be overcome before mutual trust and understanding can be established. The successful operation of a simple form of co-operation like a fair, should give the members the confidence and courage to attempt more advanced forms of co-operative enterprise.

Review.

Transport of Mangosteens by Sea. (II)

*Report on Further Experimental Consignments of Mangosteens from
Burma 1932. Empire Marketing Board Report.*

This report records the results of two further experimental consignments of mangosteens shipped from Burma to the United Kingdom. Previous consignments had been forwarded in 1929, 1930 and 1931.*

The first shipment in the present consignment consisted of 1000 fruits packed in 40 wooden trays; 500 had been picked when just ripening and 500 when almost ripe. The fruits were shipped on April 14th and arrived at Tilbury on May 13th. The temperature of carriage did not rise above 52°F. or fall below 38°F. during the voyage.

A small consignment of canned fruit was sent with each shipment for a report on the quality and suitability for market. Examination of a sample of the fruits showed that 12 per cent. of waste was present, and, in the green fruits, the flesh was hard and adhering to the rind, under-ripe and rather unpalatable. The almost ripe, sound fruit was dark-red in colour and attractive in appearance and the flesh was juicy and of good flavour. All the fruits had a hard rind.

The report states that "although carried in cool storage both the almost ripe and the just ripening fruit contained a high proportion of wastage due to fungal rotting".

The second shipment was despatched on May 7th and arrived at Tilbury on June 8th. The highest and lowest temperatures recorded during the voyage were 54°F. and 48°F.

The second consignment appeared to be in somewhat better condition than the first. "Nevertheless many fruits showed evidence of fungal infection, and samples retained at ordinary temperatures developed extensive wastage within a week".

The report states that in slightly rotted fruits infection by rotting organisms (*Diplodia* sp., *Pestalozzia* sp., *Glocosporium* sp., and *Rhizopus* sp.) had started from the stem end. In very advanced rotting the whole of the fruit was involved and the rind was covered with a black mould growth. Sometimes the rind appeared to be sound while the interior of the fruit was completely rotted.

The report further states that "In view of the nature of the infection it is evident that the majority of the wastage at the time of discharge was due to infection while the fruit was on the tree. According to preshipment information more than 25 per cent. of the fruit intended for canning was found to be rotted.

* Reviewed in *Malayan Agricultural Journal*, Vol. XX, No. 1. 1932 p. 31.

" , It was mentioned in an earlier report that the growth of *Diplodia*, is retarded " by storage at temperatures below 55°F. Wastage in fruit infected by this " organism increases rapidly, however, when storage at high temperature is " resumed. The fact that within a week the wastage was well over 50 per cent. " indicates fairly conclusively that a very large proportion of the fruit was in- " fected at the time of picking The sale of such fruit naturally often " leads to disappointment on the part of the buyer with loss of confidence when " future purchases are contemplated. In view of this it is strongly recom- " mended that, before further shipments are made, steps should be taken to " ensure that fruit at the time of packing, is sound and free from infection by " orchard—rot organisms.

" It has been previously pointed out that this can probably only be achieved " by orchard sanitation, including spraying, pruning away and burning all dead " twigs and branches. it is strongly recommended that before further " shipments are sent, efforts should be made to eradicate the cause of wastage. " With regard to future demand, the opinions were similar to those obtained " in 1931. It was considered that the demand would be very limited and would " come mainly from large stores. The product was in the nature of a speciality " and would not appeal to the general public."

With the last statement the Reviewer is in entire agreement. The mangos- teen, sold in Europe at an economic price which would repay the exporter, is hardly likely to be greatly in demand, even if wastage could be reduced to a minimum and the fruits retailed in a sound condition.

With regard to the measures suggested, to reduce the amount of infection by rotting organisms, the Reviewer is of the opinion that such measures are impracticable at least so far as Malaya is concerned. Mangosteens in this country are usually interplanted with other types of trees and it would be a costly and somewhat useless measure to spray the trees with the object of reducing the amount of infection by the organisms found in the fruits on arrival in England. The spores of these organisms are everywhere present, and, even if fruits were picked from a treated orchard, they would undoubtedly be found to be infected with spores of these organisms on the surface of the fruit. The Reviewer's experience has been that any fruit picked fresh, and apparently free from any form of rot, if placed in a sterilised container at room temperature will, in Malaya, develop signs of various mould growths at the stalk end in the space of 24 hours. Protection of the cut stalk immediately on picking, and surface sterilisation of the fruit prior to packing and storage at a suitable temperature, would seem to be methods more liable to reduce rotting in transit, than any methods of orchard sanitation, however desirable the latter may be as ordinary agricultural practice.

The trade opinions on the samples of canned fruits examined, indicate that the fruit was somewhat unattractive in appearance and insipid in flavour and that the mangosteen does not lend itself to canning, as it possesses a delicate flavour which is either masked or destroyed by the process.

It would appear from these reports that the prospects of developing a trade in the shipment of mangosteens from the East to England are not too bright. The laudable efforts of the Department of Agriculture in Burma, in this direction, are to be commended, and the results of future work will be awaited with interest. As far as Malaya is concerned, however, it is unlikely that the shipment of mangosteens to Europe, as a commercial proposition, will at present be given serious consideration.

A. T.

Miscellaneous Article.

CONDITIONS ON SMALL RUBBER HOLDINGS IN MALAYA.

First Quarter 1933.

*Prepared by the Economics Branch of the Department of Agriculture,
S.S. and F.M.S. in collaboration with the Field Branch of the
Department of Agriculture.*

Rainfall.

The rainfall in January approximated closely to the average for the month in most parts of the country, with the exceptions of the main range areas in Perak, the east coast of Pahang and a strip of the Selangor - Perak coast, where rainfall was above normal. In February, rainfall was generally below the average, droughts being experienced in the Malacca - North Johore region and in Pahang. In the inland regions of the Peninsula precipitation was below normal during March. In Selangor - Negri Sembilan and on the east coast, the rainfall was average, while in the west coast region from Malacca to Singapore the weather was abnormally wet.

Prices.

Table I in this article shows the range of prices for small-holder's rubber among local dealers, together with the average monthly Singapore price for standard sheet and the prices quoted at the end of the month by large dealers. The figures of local dealers' prices were obtained from a large number of purchasing centres where many factors such as transport and competition affect the price paid to the producer.

Tapping.

Heavy "wintering" of trees with a consequent reduction in yield, together with the absorption of labour in the work of harvesting padi led to an increase in the areas untapped during the quarter, in most parts of the country.

In Kedah, Selangor and Johore, however, tapping was reported to have been increasingly heavy during the "wintering" period in areas where small-holders were dependant upon rubber alone, in order to counter-balance the normal reduction in yield; tapping before dawn was observed to be carried out in parts of Perak and Province Wellesley with the same object.

Bark Consumption Investigations:—The work of compilation of figures obtained in connection with these investigations is nearing completion. On only 75 out of the total 90 holdings under observation for a period of a year, was tapping carried out over twelve consecutive months. Computation has already shown that on the above 75 holdings the rate of bark renewal is considerably in excess of the rate of bark excision. It is intended to publish the results of these investigations in the form of a special bulletin as soon as the work is completed.

Postponement or acceleration of bringing young rubber into tapping:—The only report of young rubber newly tapped is that from the Negri Sembilan, where an area of 333 acres was brought into tapping in the Kuala Pilah District.

Areas out of Tapping on Small Holdings.

The method of computing areas of tappable rubber which are untapped, which was described in the report for the fourth quarter of 1932, was again employed during the period under review. That is to say, counts were made of holdings tapped and untapped along the sides of main roads throughout all the larger areas of small holdings in the F.M.S., additional figures being obtained for the first time from Penang, Province Wellesley and Singapore, observations being also taken on a larger scale than before in Malacca. The resultant figures of the percentage untapped are applied to the known area under small holding rubber in each locality.

Since these counts were only made on one occasion in each District towards the end of the quarter, they cannot be taken as being anything more than a rough indication of the general position among small-holdings.

Table II shows the results of the above method of computation.

It will be seen that the total area untapped in March 1933 in the F.M.S. amounted to 133,000 acres or 26 per cent. of the total tappable area, as compared with 79,000 acres or 15.5 per cent. in December 1932, an increase of 54,000 acres or 41 per cent. The total area untapped in the S.S. amounted to 49,000 acres or 40 per cent. of the total tappable area.

Diseases

Mouldy rot.—The coincidence of the "wintering" of the trees with a period of dry weather had very considerable effect in checking the growth of mouldy-rot in all infected areas.

Oidium Heveae:—Following the wintering period, the dry conditions prevailing were favourable to the incidence of this disease. It was reported to have been found on estates and small-holdings in the Muar, Batu Pahat and Tangkah Districts of Johore, throughout all Districts of Malacca, and also between the main range and the coast of the Negri Sembilan, where, towards the end of March, its spread was rapid. There were a few mild cases of *Oidium* in Province Wellesley.

Root Diseases :—The general position as regards root diseases remains unchanged, isolated cases alone being observed among small holdings.

Grades of Rubber Made.

Figures for the comparative production of grades of rubber, where these have been recorded are as follows :—

Selangor (nine dealers in Ulu Selangor District only) smoked sheet 91 per cent., scrap and lump 9 per cent.

Penang and Province Wellesley (figures from 22 dealers in all Districts) smoked sheet 12 per cent., unsmoked sheet 69 per cent. and scrap 19 per cent.

Malacca, (figures from 26 dealers in all Districts) smoked sheet 30 per cent., unsmoked sheet 54 per cent. and scrap 16 per cent.

Perak, Krian District, smoked sheet 40 per cent., unsmoked sheet 47 per cent., scrap and slab 13 per cent. Taiping District, smoked sheet nil, unsmoked sheet 75 per cent., scrap 21 per cent. and slab 4 per cent. Tapah District, smoked sheet 7 per cent., unsmoked sheet 82 per cent. and scrap 11 per cent. Kuala Kangsar District, smoked sheet 44 per cent., unsmoked sheet 34 per cent. and scrap 22 per cent.

Tendency to Abandon Rubber Cultivation for Alternatives.

An area of 30 acres of rubber was cut down in Johore Bahru to allow for the planting of pineapples. Only a few cases have been observed of the destruction of a small number of trees to make room for the planting of fruit or vegetables in other localities.

TABLE I.
 Rubber Prices (in Straits dollars per picul i.e. 133½ lbs.)
 1st Quarter 1933.

	Singapore standard sheet Average	Singapore for small holder's rubber at end of month	Penang for small holder's rubber	Perak	Selangor	Negri Sembilan	Pahang	Malacca	Province Wellesley	Kedah	Johore
Smoked sheet.	9	8	—	6-8	4-8.50	JANUARY		7-9	6.90-8	6-9	5.30-7.50
Unsmoked sheet.		7	6.20-7	4-6.50	3-7.50	4-7.50	4-7	6-8	4-7	4-7.50	3.80-6.50
Scrap		3.20	2-3.50	1-3	2-3.50	1-3	1-2.50	2.50-4.50	1.20-3.50	1.50-3.25	1-3
Smoked sheet	8.33	7.60	—	6.40-8	5-8	FEBRUARY		7-7.75	7-7.60	5.90-9.50	4-7.20
Unsmoked sheet		6.80	6.10-6.70	4-6.80	3.50-6.50	3.50-6	4-6	4.50-6.50	4-6.50	4.90-8	4.20-6.60
Scrap		2.80	2-2.60	1-2.50	1.50-2.50	1-3	1-3	80-3.50	1.20-4	2-3.25	1-2.50
Smoked sheet.	8.04	7.60	—	6-8	5.50-7.50	MARCH		6-7.75	7-7.50	6-8.50	5.40-7.50
Unsmoked sheet.		6.80	6-6.80	4-6	5.50-6.80	4-6.90	4-6.40	4-7	5-6.70	5-7	4.50-6.50
Scrap		2.50	2.60-3	1-2.50	1.20-3.80	1-3.50	1-3	80-3.50	1.50-3	1.80-3.50	1-3

Table II
Estimated Acreage of Tappable Rubber which was out of Tapping on Holdings of less
than 100 Acres, during March 1933.

PERAK				SELANGOR				NEGRI SEMBILAN				PAHANG			
District	Total Tappable area	Total untapped area	Percentage	District	Total Tappable area	Total untapped area	Percentage	District	Total Tappable area	Total untapped area	Percentage	District	Total Tappable area	Total untapped area	Percentage
Batang Padang	36,015	13,326	37	Klang	18,449	5,535	30	Seremban	18,834	6,215	33	Raub	6,583	1,119	17
Kinta	33,886	6,099	18	Kuala Langat	29,108	4,366	15	Tampin	17,591	3,826	22	Kuala Lipis	15,147	6,816	45
Kuala Kangsar	42,665	7,253	17	Ulu Langat	38,425	6,916	18	Kuala Pilah	17,253	6,556	38	Bentong	13,005	5,722	44
Upper Perak	12,378	5,199	42	Ulu Selangor	29,272	6,147	21	Telebu	6,248	562	9	Other Districts	29,498	11,504†	39†
Larut & Selama	50,474	12,618	25	Kuala Lumpur	21,062			Port Dickson	9,995	3,098	37				
Krian	9,598	5,951	62		8,870	5,986	20								
Lower Perak	46,412	7,890*	17*	Kuala Selangor											
	231,428	58,336	25		145,186	28,950	20		69,721	20,857	30		64,233	25,168	39
MALACCA				PENANG & P. WELLESLEY				SINGAPORE							
District	Total Tappable area	Total untapped area	Percentage	District	Total Tappable area	Total untapped area	Percentage		Total Tappable area	Total untapped area	Percentage				
Central	17,687†	9,728	55	North	3,202	1,921	60	Singapore	12,332	7,646	62				
Alor Gajah	29,948	11,380	38	Central	6,967	1,393	20								
Janin	24,582	5,430	22	South	7,813	1,641	21								
				Dindings	7,279	4,513	62								
				Penang	11,019	4,958	45								
	72,317	26,538	37		36,280	14,426	40		12,332	7,646	62				

The percentage of areas out of tapping in December 1932, was as follows:—Perak 9, Selangor 16, the Negri Sembilan 27, and Pahang 23.

* Estimated from same percentage as shown in Kuala Kangsar District.

† Estimated from mean percentage for remainder of State.

‡ Tappable area estimated from the total area planted up to end of 1931, i.e. 17,732 acres.

Departmental.

FROM THE DISTRICTS.

The Weather.

Rainfall approximated to normal throughout the Peninsula, being heavy in the inland region, much less heavy as compared with last month generally on the East coast and comparatively low at Kota Bahru in Kelantan.

Thunderstorms were general inland, which probably partly accounts for local patchiness in precipitation as, for instance, at Kuala Kangsar in Perak, where the figures are much below the average, although many surrounding localities received a higher quota than the average for the month.

Remarks on Crops.

Rubber.—There was a slight upward tendency in the price offered for small-holder's rubber towards the end of the month as is reflected in the range of prices reported from all centres. The highest and lowest prices recorded in dollars and cents per pikul are; smoked sheet, \$5 to \$11.40; unsmoked sheet \$4 to \$8.50; scrap 80 cents to \$3.55. The average Singapore price recorded for small-holder's rubber is; smoked sheet \$7.80; unsmoked \$6.80 and scrap \$2.70 whilst the range of prices in Penang was, for unsmoked sheet \$8.60 to \$6.20 and for scrap \$3.30 to \$2.

An increase in the number of holdings being tapped as the result of the upward price tendency is reported from parts of Perak and Selangor.

There is an encouraging consensus of opinion in many reports that, notwithstanding the wet weather, Mouldy rot disease is not so much in prominence as might be expected under the circumstances. There is evidence of a general attempt at control of damage by periodic paintings. This does not imply that there are any real efforts to rid infected areas of the disease, but it does definitely indicate that serious bark injury is being largely guarded against.

Reference to undergrowth in rubber holdings is rather more stressed in the month's reports than usual, probably because the wet weather has induced fresh growth of the herbage existing amongst most Malay owned rubber. In most cases Chinese and Indian owned holdings are cleaner weeded than those owned by Malays.

Padi.—Harvesting having been for the most part completed last month there is little of interest to report under this heading. Estimates of yields are not sufficiently complete to provide any definite information on the subject but, speaking generally, the crop has been satisfactory throughout the country. In Pahang it is estimated that the total area under padi, including land temporarily leased, was 44,790 acres, an increase in area of approximately 10,000 acres as compared with last season.

Satisfactory progress is reported to have taken place in the irrigation scheme for Sungei Manik in Lower Perak and irrigation facilities are expected to be available for the coming season.

At the Bagan Serai Mill, the price for padi continues to be maintained at \$1.60 a pikul which is equivalent to 6½ cents a gantang.

Coconuts and Copra.—The price of copra has fallen still further during the month.

This fact increases the difficulty of placing newly operating improved kilns on a business footing but, notwithstanding, profitable transactions are reported from several of the more satisfactory kiln groups.

In Selangor, the standard of manufacture at the Sabak Bernam kilns remains satisfactory and the same applies to the better managed kilns in Kuala Selangor. There is no improvement in the position at Klang where it is still difficult to obtain nuts for working the kiln. On the other hand, in the Kuala Langat District there is an increasing tendency for Malay growers to manufacture coconut oil, which is sold locally and produces higher profits than are obtained by the sale of copra.

In Province Wellesley, a sale of copra from the Sungei Acheh kiln made a small profit, and a fresh kiln, designed to take 1,000 nuts, is in course of erection in the Central District.

In the Bagan Datoh District of Perak, certain improvements have been effected in a recently constructed kiln and further progress has been made in the construction of another brick kiln, whilst arrangements have been made for the construction of one clay and one brick kiln at Rungkup and a clay kiln in Utan Melintang mukim. It is unfortunate that the first lot of copra prepared on the recently improved kiln first mentioned was unsatisfactory owing, apparently, to faulty methods of firing.

In Pahang, a kiln erected at Temerloh is ready to start operations and the matter of arranging for the sale of any copra produced is receiving attention.

Tobacco.—This crop again features more prominently in many reports indicating an increasing interest. About 50 acres were planted in the Baling District of Kedah. In Province Wellesley, nursery beds have been laid down by Chinese in many areas in the Central District as the result of an increase in the local price of the product.

Small areas were planted during the month in Perak and Selangor and interest in the crop is still maintained in Singapore.

The range of prices quoted per picul for cured leaf at different parts of the country are as follows, Kedah \$14 to \$28; Province Wellesley, 1st grade \$45 to \$52; 2nd grade \$39 to \$45; Selangor \$25 to \$42.

Agricultural Stations.

Seasonal planting activity in relation to the supplying of permanent crops and sowing of annual crops is recorded from most stations. The programme for Bukit Mertajam Station in Province Wellesley included the planting of a

fairly large collection of vegetables and preparations for planting tobacco. Improvement in the appearance of all crops is recorded at Selama and Kuala Kangsar Stations, although, at the latter, weeds are causing much difficulty. In the Negri Sembilan, a satisfactory lay-out and planting programme has been proposed for Rembau Station, and a lay-out for Kuala Pilah Station is being formulated. At Sungei Udang Station in Malacca, considerable progress has been made in terracing and levelling an area on the left of the entrance road and in filling in an old river bed. In Pahang, further planting has been done at the Kuala Lipis and Pekan Stations, and much clearing has been done at the Kuantan Station. At the Pineapple Station, Singapore, increased crops are being produced from the manurial and mulched plots and a green manure plot has been prepared for planting. A second planting of tobacco in the rotation block was completed. In Brunei, surveying and clearing have been carried out on the area chosen for the main Agricultural Station and fencing has begun.

An experiment designed to throw further light on soil fertility problems, peculiar to the tropics, has been formulated at headquarters which is to be laid down on most of the Agricultural Stations in the country.

Padi Stations and Test Plots.

Inter-season vegetable crops planted at Bukit Merah Station in Province Wellesley are making good growth. The bunding of Test Plots in Krian is in progress. At Talang in Perak, fencing was completed on an area set apart for rotation grazing experiments. Nurseries have been established on the Negri Sembilan and several of the Pahang Test Plots; planting is completed at Kuang Test Plot and nurseries are established at the Kajang Test Plot in Selangor. Elsewhere, the land is lying fallow and next year's planting programmes are under consideration. The results of last year's manurial experiments have been examined and a cultural and manurial experiment has been prepared for inclusion at all Padi Stations next season.

DEPARTMENTAL NOTES.

Visits of the Director of Agriculture.

The Director of Agriculture, Dr. H. A. Tempany, C.B.E., visited Malacca from April 1st to April 3rd. During his visit he addressed the Malacca Planters' Association on the subjects of the economics of the rubber and rice industries and the general agricultural outlook for Malaya, and discussed administrative questions with the Resident Councillor, the Agricultural Field Officer and certain members of the planting community. He also visited and inspected the Agricultural Station, Sungei Udang, the Rice Breeding Station, Pulau Gadong, and the new works in connection with the Bachang and Tanjong Minyak irrigation and drainage scheme for rice cultivation.

On April 13th the Director visited Fraser's Hill and inspected the Government Farm.

Meeting of the Inter-Departmental Propaganda and Marketing Committee.

At the close of a meeting of the above Committee which was held on April 11th, Dr. Tempany, on behalf of the Agricultural Department and Rubber Research Institute members of the Committee, expressed the regret felt at the impending departure of Mr. A. Cavendish, M.C.S., Director of Co-operation, and wished him good luck and happiness in his retirement.

Leave and Staff Changes.

Mr. F. de la Mare Norris has been granted full-pay leave, prior to retirement, of 2 months and 25 days, from April 28th to July 22nd.

Mr. J. Fairweather, Agricultural Officer, Johore North, has been appointed to act as Principal Agricultural Officer, Johore, from April 28th.

Mr. F. C. Cooke, Assistant Chemist for Copra Research, has been granted 7 months and 6 days full pay leave from April 29th to December 4th.

Mr. R. A. Altson, Assistant Mycologist, returned from leave on May 2nd.

RETIREMENT OF Mr. A. CAVENDISH, M.C.S., DIRECTOR OF CO-OPERATION.

The retirement of Mr. A. Cavendish, M.C.S., from the post of Director of Co-operation—removes a personality who has been associated closely with the work of Agricultural Department for many years past.

The Department of Co-operative Societies was founded in the year 1923, and Mr. Cavendish has discharged the functions of Director since its inception.

For the building up of the co-operative organisation in Malaya Mr. Cavendish has been largely responsible, and the Department remains as a monument to his work. It is an open secret that he refused, on more than one occasion, promotion to higher rank in the administrative service in order to ensure the continuity of the work he had started.

It is mainly in connection with rural co-operation that Mr. Cavendish's work came into contact with that of the Agricultural Department. It is essential for success to be achieved in this connection, and also in the cognate sphere of marketing peasant produce, that the closest touch should be maintained between the two Departments. This Mr. Cavendish always recognised, and it is a pleasure to recall the continuous and amicable association with him which existed throughout the writer's period of service in Malaya.

Mr. Cavendish served for some years as a member of the Agricultural Advisory Committee and of the Advisory Committee for the School of Agriculture; he was Chairman of the Film Propaganda Committee which administered the working of the Rural Lecture Caravan, operated by the Departments of Co-operation and Agriculture and the Rubber Research Institute.

Latterly he served as Chairman of the newly established Inter-departmental Propaganda and Marketing Committee which incorporated the Film Committee and extended its functions to the difficult question of marketing peasant produce.

He collaborated with the Department of Agriculture in a number of agricultural conferences, and took a leading part in organising the Inter-departmental Conference which met in August 1932.

His interest and keenness on all matters pertaining to agriculture was un-failing, and he combined with it a personality of rare charm.

He carries with him the best wishes of the staff of the Department of Agriculture for a long and happy period of retirement.

H. A. T.

Statistical.

MARKET PRICES

April 1933.

Rubber.—The highest spot price recorded in Singapore during April for smoked sheet equal to London Standard was 7 15/16 cents on 7th and 29th and the lowest price 6 cents on 4th and 5th. The average price for the month was 6.92 cents per lb. in Singapore, 2.34d. in London and 3.47 cents gold in New York, as compared with 6.09 cents, 2.03d. and 3.03 cents gold respectively in March.

Palm Oil.—The course of the English market during April, on a basis of 18 per cent. f.f.a., c.i.f. Liverpool was as follows:—2nd, £13.10.0 per ton; 9th, £14.5.0; 15th, £14.5.0; 23rd, £13.15.0; and £15 per ton for Sumatra oil in bulk on 30th. Prices in the U.S.A. landed weight in bulk c.i.f. New York/Philadelphia were 2.10 cents gold per lb. on 11th, 2.20 cents on 19th and 2.97 cents on 29th.

The price of palm kernels, Fair Average Malayan Quality c.i.f. landed weight on the Continent rose from 7 shillings and 10½d. per cwt. on 11th to 8 shillings and 3d. on 29th.

Copra.—Prices have declined and the market has been depressed. The highest Singapore price for sundried during April was \$3.95 per picul on the 3rd of the month, the average price being \$3.82 per picul as compared with \$4.35 for March. The mixed quality averaged \$3.56 as compared with \$4.03 in March.

Coffee.—Prices at Singapore for Sourabaya coffee declined towards the end of the month, ranging from \$22.50 to \$26 as compared with \$24.50 to \$25.75 during March: the price within the range depending on quality.

Palembang coffee averaged \$18.87 as compared with \$19.80 in March.

Arecanuts.—Palembangs averaged \$2.32 per picul and Bila Whole averaged \$2.33 as compared with \$2.16 and \$2.45 respectively in March. The range of Singapore prices for other grades were:—Split \$3 to \$5; Red Whole \$2.75 to \$4; Sliced \$5.75 to \$8; Kelantans \$3.50 to \$4 per picul, the price within each range depending on quality.

Rice.—The following are the average wholesale prices per picul of rice in Singapore during March:—Siam No. 2 \$3.40, Rangoon No. 1 \$3.05, as compared with \$3.41 and \$3.26 per picul during January. The average retail market prices in cents per gantang of No. 2 Siam rice in March were:—Singapore 26, Penang 28, Malacca 27, as compared with 25, 28 and 27 cents respectively in January.

Gambier.—Block Gambier declined slightly during the month the average price being \$4.44 per picul and Cube remained steady at \$8 per picul.

Pineapples.—Demand has been dull: the average Singapore prices per case

in April were :—Cubes \$2.99, Sliced Flat \$2.89, Sliced Tall \$3.11, as compared with \$2.95, \$2.80 and \$3.04 respectively during March.

Tapioca.—There has been a further decline in prices towards the end of the month. Flake depreciated from \$4.50 to \$4 per picul towards the end of the month, and Pearl Seed from \$5 to \$4.75 the average price per picul of the latter being \$4.93 as compared with \$5.69 during March.

The price of Flake averaged \$4.17 as compared with \$5.69 in March and Pearl medium averaged \$5.12 as compared with \$6.12 in the previous month.

Sago.—Pearl small fair rose slightly, the average being \$4.42 as compared with \$4.13. Flour Sarawak Fair averaged \$1.79 as compared with \$1.90 in March.

Mace.—Prices, more or less nominal, are quoted at \$62 per picul for Siouw and \$40 for Amboina.

Similar prices have ruled for the past five months.

Nutmegs.—There has been no demand during the month. The average Singapore prices per picul for 110's were \$19.50 and 80's \$24.25 as compared with \$20.50 and \$24.50 per picul respectively during March.

Pepper.—Average Singapore prices during April were as follows :—Singapore Black averaged \$13.62 per picul, Singapore White \$20.94 and Muntok White \$21.50, the corresponding prices for March being \$15, \$21.31 and \$21.75 respectively.

Cloves.—There has been no demand for cloves, nominal prices being quoted at \$40 for Zanzibar and \$45 per picul for Amboina.

The above prices are based on London and Singapore daily quotations for rubber; the Singapore Chamber of Commerce Weekly Reports for the month and on other local sources of information. Palm oil quotations are kindly supplied by Messrs. Cumberbatch & Co., Ltd. and Messrs. Guthrie & Co. Ltd., Kuala Lumpur, and the Singapore prices for coffee and arecanuts by the Lianqui Trading Company of Singapore.

1 picul = 133½ lbs. The Dollar is fixed at 2s. 4d.

Note.—The Department of Agriculture will be pleased to assist planters in finding a market for agricultural products. Similar assistance is also offered by the Malayan Information Agency, 57, Charing Cross, London, S.W. 1.

GENERAL RICE SUMMARY.

March, 1933.

Malaya.—Gross foreign imports of rice (including stocks available for re-export) during March 1933, amounted to 47,720 tons (as compared with 47,189 tons in March 1932) of which 52 per cent. were consigned to Singapore, 21 per cent. to Penang, 9 per cent. to Malacca, 17 per cent. to the Federated Malay States and 1 per cent. to the Unfederated Malay States.

Of these imports, 56 per cent. were from Siam, 41 per cent. from Burma, 1 per cent. from Indo-China and 2 per cent. from other countries.

Total foreign exports of rice from Malaya in March 1933, were 16,424 tons (including 282 tons local production) as compared with 13,668 tons in March of the previous year.

Of these exports 89 per cent. were consigned to Netherlands India and 11 per cent. to other countries.

Net imports for the period January to March 1933, amounted to 98,448 tons as compared with 114,085 tons during the same period for 1932, a fall of 14 per cent.

India and Burma.—Total foreign exports of rice during February 1933, were 174,000 tons as compared with 68,000 tons in the previous month and 241,000 tons in February 1932, an increase of 155.9 per cent. in respect of the previous month and a decrease of 28 per cent. in respect of the same period in the previous year.

Japan.—The position from March 1 to the end of October 1933 is estimated as follows:—Supply (including stocks on March 1st and imports from Korea, Formosa and other countries) 7,332,000 tons, consumption 6,268,000 tons, exports, 28,000, balance available as November 1st, (the beginning of the new season) 1,036,000 tons.

Siam.—Exports from Bangkok (approximate) during March 1933, amounted to 162,422 tons as compared with 158,232 tons (actual) in March 1932, an increase of 2.6 per cent.

Netherlands India, Java and Madura.—At the end of February 1933, the area harvested amounted to 425,000 acres a decrease of 23,000 acres or 5 per cent. as compared with the corresponding period of 1932, the area damaged was 11,000 acres a decrease of 6,000 acres or 35 per cent. as compared with 1932, and additional plantings awaiting harvesting amounted to 7,019,000 acres an increase of 24,000 acres or 0.3 per cent. The total acreage at the end of February 1933, amounted to 7,455,000 acres of which 6,405,000 acres were wet padi and 1,050,000 acres dry padi, a decrease of 11,000 acres or 0.1 per cent. as compared with the same period in the preceding year.

Imports of rice into Java and Madura during the period January and February 1933, totalled 36,270 tons, a decrease of 12,675 tons or 26 per cent. as compared with the same period of 1932.

Imports of rice into the Outer Provinces during January amounted to 18,738 tons, a decrease of 3,347 tons or 15 per cent. as compared with the same period of 1932.

An ordinance was promulgated at Buitenzorg on 21st March, prohibiting the importation of rice into the customs area of Netherlands India for a period of four months. The Celebes and the East Coast Province of Sumatra alone being permitted to import rice sufficient to fulfil their requirements.

French Indo-China.—Entries of padi at the port of Cholon from January to March 1933, amounted to 326,000 (metric) tons, a decrease of 5,000 tons or 2 per cent. as compared with the same period of 1932.

Exports of rice from Saigon for the period January to March totalled 361,000 tons, an increase of 42,000 tons or 13 per cent. as compared with the corresponding period of 1932.

Ceylon.—Imports for the period January and February 1933, totalled 71,252 tons, a decrease of 17,798 tons or 20 per cent. on the imports for the same period of 1932.

Of these imports 18 per cent. were from British India, 76 per cent. from Burma and 6 per cent. from other countries.

Europe and America.—Quantities of rice shipped from the East were:—

- (a) To Europe for the period January 1st to March 16th, 207,533 tons, an increase of 75,992 tons or 58 per cent. as compared with the same period of 1932. Of these shipments 42 per cent. were from Burma, 11 per cent. from Japan, 37 per cent. from Saigon, 9 per cent. from Siam and 1 per cent. from Bengal, as compared with 61 per cent. from Burma, nil from Japan, 30 per cent. from Saigon, 2 per cent. from Siam and 7 per cent. from Bengal in 1932.
 - (b) To the Levant, period January 1st to February 15th, 2,315 tons, a fall of 6,691 tons as compared with the same period of 1932.
 - (c) To America and the West Indies for the period January 1st to February 15th, 11,825 a decrease of 8,798 tons as compared with the same period of 1932.
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MALAYA RUBBER STATISTICS

ACREAGES OF TAPPABLE RUBBER NOT TAPPED ON ESTATES OF 100 ACRES AND OVER, FOR THE MONTH ENDING MARCH, 1933.

STATE OR TERRITORY	ACREAGE OF TAPPABLE RUBBER end 1932	ESTATES WHICH HAVE ENTIRELY CEASED TAPPING		ESTATES WHICH HAVE PARTLY CEASED TAPPING		Total (3) + (5)	Percentage of (7) to (2)
		Acreage (3)	Percentage (3) to (2) (4)	Acreage (5)	Percentage (5) to (2) (6)		
(1)	(2)		(4)	(5)	(6)	(7)	(8)
FEDERATED MALAY STATES :—							
Perak	250,951	15,826	6.3	32,546	13.0	48,372	19.3
Selangor	308,379	19,255	6.2	38,482	12.5	57,737	18.7
Negri Sembilan	228,541	18,918	8.3	22,311	9.8	41,229	18.1
Pahang	38,141	9,365	24.6	4,275	11.2	13,640	35.8
Total F.M.S.	826,012	63,364	7.7	97,614	11.8	160,978	19.5
STRAITS SETTLEMENTS :—							
Province Wellesley	44,734	2,488	5.6	8,867	19.8	11,355	25.4
Dindings	6,969	404	5.8	960	13.8	1,364	19.6
Malacca	111,780	5,687	5.1	22,553	20.2	28,240	25.3
Penang Island	1,635	1,359	83.1	50	3.1	1,409	86.2
Singapore Island	28,269	13,465	47.6	3,914	13.8	17,379	61.4
Total S.S.	193,387	23,403	12.1	36,344	18.8	59,747	30.9
UNFEDERATED MALAY STATES :—							
Iohore	325,747	41,237	12.7	33,062	10.1	74,299	22.8
Kedah (a)	114,551	9,304	8.1	8,202	7.2	17,506	15.3
Kelantan	21,175	10,281	48.5	1,352	6.4	11,633	54.9
Trengganu (b)	4,352	Nil	Nil	2,072	47.6	2,072	47.6
Perlis (a)	957	106	11.1	502	52.5	608	63.5
Total U.M.S.	466,782	60,928	13.0	45,190	9.7	106,118	22.7
Total MALAYA	1,486,181	147,695	9.9	179,148	12.1	326,843	22.0

Notes :— (a) Registered companies only and are rendered quarterly.

(b) Registered companies only.

The above table together with a Summary, was prepared and published by the Statistics Department, S.S. and F.M.S. in April 1933.

MALAYAN AGRICULTURAL EXPORTS, MARCH, 1933.

PRODUCT.	Net Export in Tons.				
	Year 1932	Jan.-March 1932	Jan.-March 1933	March 1932	March 1933
Arecanuts ...	20,280	7,108	5,506	2,668	973
Coconuts, fresh ...	108,123†	22,977†	21,609†	9,760†	5,455†
Coconut oil ...	11,932	2,642	4,636	931	1,676
Copra ...	97,464	18,643	20,902	5,590	1,911
Gambier, all kinds ...	1,925	829	593	326	199
Palm kernels ...	1,248	265	353	95	154
Palm oil ...	7,892	1,444	1,102	623	540
Pineapples, canned ...	66,291	16,374	12,935	4,438	3,910
Rubber ...	417,137	105,071	99,304	29,896	31,917
Sago,—flour ...	10,267	3,762	1,481	734	112
" —pearl ...	3,228	642	505	191	157
" —raw ...	4,148*	1,049*	1,078*	471*	361*
Tapioca,—flake ...	9,028	2,178	3,055	852	1,141
" —flour ...	392	95*	36	78*	328*
" —pearl ...	19,977	4,672	3,465	2,076	1,047
Tuba root ...	165‡	30	80	28	37

† hundreds in nubmer.

* net imports.

AREAS OF TAPPABLE RUBBER OUT OF TAPPING IN
NETHERLANDS INDIA AT END OF DECEMBER 1932.*

(On Estates only, excluding Native Rubber).

	A Totally Ceased.		B Partly Ceased.		Total A & B	
	Estates	Area in acres	Estates	Area in acres	Estates	Area in acres
Java and Madura ...	153	71,035	71	18,191	224	89,226
Outer Provinces ...	203	82,362	68	36,472	271	118,834
Netherlands India ...	356	153,397	139	54,663	495	208,060

The total area out of tapping for December amounts to 22 per cent. of the total tappable area at the end of December 1931.

* The above figures are obtained from the Economisch Weekblad dated 17th February 1933.

TABLE I
MALAYA RUBBER STATISTICS
STOCKS, PRODUCTION, IMPORTS AND EXPORTS OF RUBBER, INCLUDING LATEX, CONCENTRATED LATEX AND REVERTEX,
FOR THE MONTH OF JANUARY, 1933 IN DRY TONS.

Territory	Stocks at beginning of month 1			Production by Estates of 100 acres and over			Imports			Exports including re-exports during the month			Stocks at end of month		
	Dealers	Estates	Ports	during the month	January to March 1933	January to March 1933	Foreign	From Straits Settlements	From Malaya	Foreign	Local	Foreign	Local	Dealers	Estates
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
MALAY STATES:—															
Federated Malay States ...	...	12,594	13,123	9,880	32,381	7,441	21,853	Nil	Nil	Nil	14,364	5,823	41,179	18,148	11,855
Ipohore ...	...	2,663	3,493	3,336	10,085	3,934	11,889	Nil	2	Nil	1,036	6,589	3,908	19,285	2,544
Kedah ...	...	616	2,133	1,834	6,515	1,921	3,275	Nil	Nil	Nil	1,295	1,938	3,576	7,215	953
Perlis ...	...	28	18	24	24	4	83	Nil	Nil	Nil	20	Nil	60	...	12
Kelantan ...	...	8	172	118	404	446	136	Nil	Nil	Nil	60	468	190	1,048	144
Trengganu ...	...	55	30	106	262	32	136	Nil	Nil	Nil	Nil	158	Nil	382	55
Total Malay States	...	16,036	18,989	16,250	49,671	12,888	38,006	Nil	2	Nil	16,752	15,006	47,854	46,145	15,176
SETTLEMENTS:—															
Malacca ...	...	6,378	1,453	1,193	3,772	...	...	Nil	Nil	9	5,162	...	...	5,910	1,361
Province Wellesley	...	1,087	555	369	1,405	...	...	Nil	15,930	Nil	...	...	...	898	447
Dindings ...	...	28	97	92	284	...	...	481	Nil	1,477	...	...	...	107	30
Penang ...	...	1,414	4,489	8	1	...	...	5,739	15,719	...	...	...	...	849	4,524
Singapore ...	...	4,318	16,640	196	145	425	...	6,213	15,030	17,196	...	...	...	2,392	14,563
Total Straits Settlements	...	5,732	28,692	2,269	1,900	5,888	1,948	5,739	6,213	17,196	...	...	...	3,234	30,855
TOTAL MALAYA	...	5,732	44,658	21,278	17,080	55,559	14,836	4,3745	6,213	15,032	17,196	46,24	42,059	15,006	126,222
															46,145
															3,234
															46,081
															18,318

TABLE II
DEALERS' STOCKS IN DRY TONS

Class of Rubber	Federation		Penang		Province Wellesley		Ipohore		Total	
	Malay States	Straits Settlements	Malay States	Straits Settlements	Malay States	Straits Settlements	Malay States	Straits Settlements	Malay States	Straits Settlements
20	21	22	23	24	25	26	27	28	29	30
DRY RUBBER	8,886	17,623	4,008	6,595	955	38,097	...	...	...	...
WET RUBBER	2,969	1,940	516	173	1,559	7,157	...	...	...	...
TOTAL	11,855	19,563	4,524	6,768	2,514	45,254	...	...	...	...

TABLE III
FOREIGN EXPORTS

Ports	For month	
	January 1933	January 1933
Singapore	...	22,736
Penang	...	10,954
Port Swettenham	...	15,590
Malacca	...	1,932
MALAYA	...	42,059

TABLE IV
DOMESTIC EXPORTS

Area	For month	
	January 1933	January 1933
Malay States	...	36,539
Straits Settlements	...	108,244
MALAYA	...	36,539

- Notes:—* 1. Stocks on estates of less than 100 acres and stocks in transit on rail, road or local steamer are not ascertained.
2. The production of estates of less than 100 acres is estimated from the formula: Production + Imports + Stocks at beginning of month = Exports + Stocks at end of month. + Consumption, i.e., Column (7) = Column (13) + (14) + (17) + (18) + (19) + (20) + (21) + (22) + (23) + (24) + (25) + (26) + (27) + (28) + (29) + (30) + (31) + (32) + (33) + (34) + (35) + (36) + (37) + (38) + (39) + (40) + (41) + (42) + (43) + (44) + (45) + (46) + (47) + (48) + (49) + (50) + (51) + (52) + (53) + (54) + (55) + (56) + (57) + (58) + (59) + (60) + (61) + (62) + (63) + (64) + (65) + (66) + (67) + (68) + (69) + (70) + (71) + (72) + (73) + (74) + (75) + (76) + (77) + (78) + (79) + (80) + (81) + (82) + (83) + (84) + (85) + (86) + (87) + (88) + (89) + (90) + (91) + (92) + (93) + (94) + (95) + (96) + (97) + (98) + (99) + (100) + (101) + (102) + (103) + (104) + (105) + (106) + (107) + (108) + (109) + (110) + (111) + (112) + (113) + (114) + (115) + (116) + (117) + (118) + (119) + (120) + (121) + (122) + (123) + 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METEOROLOGICAL SUMMARY, MALAYA, MARCH, 1933.

LOCALITY	AIR TEMPERATURE IN DEGREES FAHRENHEIT							EARTH TEMPERATURE		RAINFALL						BRIGHT SUNSHINE							
	Means of			Absolute Extremes				At 1 foot	At 4 feet	Total			Most in a day		Number of days				Total	Daily Mean	Per cent		
	A.	B.	Min.	Max.	Mean and range	Highest									Lowest		Precipitation, .01 in or more	Thunder- storm				Fog morning or afternoon	Gale force 8 or more
						°F	°F								°F	°F							
		°F	°F	°F	°F	°F	°F	°F	°F	°F	in.	mm.	in.	mm.	in.	mm.	hr.	hr.	%				
Railway Hill, Kuala Lumpur, Selangor	91.2	72.5	81.8	94	70	81	74	84.6	84.9	11.00	279.4	2.84	21	20	7	3	173.05	5.58	46				
Bukit Jeram, Selangor	87.4	72.5	79.9	90	70	80	75	84.4	86.4	6.63	168.4	1.54	17	14	3		216.70	6.99	58				
Sitiawan, Perak	90.3	73.0	81.7	94	69	79	76	85.0	85.4	3.86	98.1	2.51	9	8	5	1	208.30	6.72	55				
Kroh, Perak	90.6	68.9	79.7	95	65	73	72	83.1	82.7	6.98	177.3	1.40	12	10	3		246.25	7.94	66				
Temerloh, Pahang	88.8	72.2	80.5	94	69	75	74	85.3	85.3	8.36	212.3	2.14	13	12	2		200.05	6.45	53				
Kuala Lipis, Pahang	89.5	71.9	80.7	94	69	74	75	84.0	84.0	3.57	90.7	1.08	17	8	1	16	194.90	6.29	52				
Kuala Pahang, Pahang	86.0	75.0	80.5	88	72	79	79	85.5	85.0	9.91	251.7	2.63	14	13	1		244.10	7.87	65				
Mount Faber, Singapore	87.7	72.9	80.3	92	68	77	76	80.8	81.5	10.97	268.6	2.01	20	19	4		178.00	5.74	47				
Butterworth, Province Wellesley	88.6	74.1	81.3	91	71	77	78	85.6	85.4	7.44	189.0	2.77	11	9	1		256.75	8.25	69				
Bukit China, Malacca	86.7	73.9	80.3	91	71	77	76	83.0	84.1	10.51	266.9	2.85	12	11	5		209.35	6.75	56				
Kluang, Johore	87.6	71.9	79.7	93	70	79	75	80.7	81.2	12.90	327.7	4.22	20	18	7	6	166.75	5.38	44				
Bukit Lalang, Mersing, Johore	84.3	72.6	78.5	88	69	79	78	80.3	80.2	11.69	296.9	6.40	11	11	1	1	222.10	7.16	59				
Alor Star, Kedah	92.8	72.1	82.5	96	68	77	76	85.2	85.0	6.94	176.3	2.42	10	10	6		262.00	8.45	70				
Kota Bharu, Kelantan	87.2	71.2	79.2	92	67	74	75	82.2	82.6	7.78	197.6	3.91	7	5	1		268.50	8.66	72				
Kuala Trengganu, Trengganu	86.5	71.7	79.1	90	69	82	76	83.0	83.2	5.77	146.6	2.79	9	6	2		248.95	8.03	66				
HILL STATIONS.																							
Fraser's Hill, Pahang 4268 ft.	71.9	62.3	67.1	77	58	64	65	71.7	72.1	9.88	250.9	1.80	20	18	22		121.85	3.93	32				
Pahang Highlands, Tanah	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Cameron Highlands, 4750 ft.	72.7	55.7	64.2	76	48	65	63	68.9	68.6	6.40	162.6	1.01	18	14	2	1	158.25	5.10	42				
Cameron Highlands, Rhododendron Hill, Pahang 5120 ft.	72.2	58.7	65.5	77	55	66	62	...	...	7.40	188.0	1.07	18	14	1	1	171.30	5.53	46		

Compiled from Returns supplied by the Meteorological Branch, Malaya.

THE Malayan Agricultural Journal.

JUNE, 1933.

EDITORIAL.

Poultry in Malaya.

During the past eighteen months interest in the subject of poultry keeping in Malaya has become greatly intensified. This is probably largely due to the depression, combined with the growing realisation that poultry and eggs comprise two of the many necessities of life for which Malaya is dependent in a very large and unnecessary degree on foreign sources.

To illustrate how great this dependence is, the following figures taken from Customs returns may be quoted.

Imports of live poultry in 1932 amounted to 928 thousand head valued at \$600,000 and imports of dead poultry to 38 tons valued at \$44,000; 17 million eggs valued at \$300,000 were also imported into Malaya in 1932.

Poultry keeping both by small-holders and also by a certain number of amateurs has been practised in Malaya for many years past, but has never attained the hold which it has procured in other countries. This is partly due to the extraordinary prosperity which has been the lot of the country until recent years, and which has caused it to form a market for the produce of its then less fortunately situated neighbours, but also to difficulties inherent to poultry keeping owing particularly to the inroads of disease.

There appears to be no reason to suppose that Malaya is any worse situated than many of her neighbours in this respect, on the other hand the amount of information regarding the incidence and character of poultry diseases occurring in Malaya, available to the general public, is so small as to be almost negligible.

It is widely realised that in this country, from time to time, heavy toll is likely to be taken of the poultry population by waves of disease, but of the nature of them little or nothing is known. It is in fact customary to speak of the cause of mortality as 'the disease' but no accurate description of symptoms has, so far as is known, been placed on record, while the cause has variously been ascribed to a germ, to weather conditions, and to improper feeding.

In point of fact, reference to conditions in other countries where more is known concerning the incidence of poultry disease indicates that it is highly probable that the position is not due to one disease but to a number, while condi-

tions are probably also adversely affected by other factors, including feeding, housing and weather.

As a first step towards providing readily accessible information regarding the incidence of disease, an article which appears in this number of the *Malayan Agricultural Journal* has been compiled by Mr. H. D. Meads from current literature giving an account of diseases known to occur in certain other countries which may reasonably be supposed to be prevalent in Malaya. It is believed that the information so provided should prove of value, and while it may require to be supplemented for local conditions it at least affords a basis on which observations can be made and further knowledge accumulated.

It will be seen that the four diseases of the intestinal tract, described in the article, are the most virulent and infectious of any of those which attack poultry, and a careful watch should be kept on the birds so that their incidence may be recognised in the earliest stages. Any individual showing symptoms of diarrhoea together with general ill-health, lassitude and unkempt plumage, should at once be treated as a suspect and be isolated from the remainder of the flock, and, at the same time, daily inspection of all birds should be carried out with increased vigilance.

Although certain medicines are recommended as being of use in the treatment of affected birds, it cannot be too strongly emphasised that there are no cures for intestinal diseases of poultry. As soon as an intestinal disease has been diagnosed, the poultry keeper should immediately destroy all affected birds, the carcasses of which should be burnt or buried deeply in a place which is distant from the poultry run. All individuals subsequently observed among the flock should be thus dealt with at the onset of similar symptoms. By this method alone can the spread of disease be checked.

At the same time, by reason of the fact that the casual organisms are voided by diseased birds in large numbers, the ground on which such birds are kept becomes a source of infection and it is important that, whenever possible, healthy birds should not be allowed access to such ground for a period of 6 months.

Although the common practice in Malaya of allowing birds to have free range is a desirable one from the point of view of economy, both in housing and in diet, it renders difficult the segregation of infected birds and the enclosing of areas of infected ground. It is advised that a small wired-in house and pen should be erected for the isolation of sick birds where they may be kept under more direct supervision and also be prevented from fouling the common area.

Once the presence of any infectious disease has been established, and the affected birds removed to the isolation run pending their destruction, this area of ground should remain shut off from the remainder of the flock for the above mentioned period of 6 months or more, the house being thoroughly washed with a strong disinfectant.

A small enclosed run should also be set apart for the rearing of newly hatched broods during the first few months of life on all areas where diseases,

intestinal parasites or gape worms have made their appearance among adult birds, in order that the chances of infection of the young chickens may be minimised.

The Department of Agriculture will welcome any observations on diseases by poultry keepers in Malaya, since it is urgently required to widen the scope of the information at present available on this important subject.

Coconut Seed Selection.

The importance of using good seed, when planting an area with any crop, is well recognised. The up-to-date planter endeavours to use only the best seed of suitable strains, with the hope of securing better growth and a higher yield than is likely to be obtained through the use of inferior material. In the case of most of the annual crops, and many of the perennial crops, in every part of the world, proved seed naturally is planted in preference to any other.

When it is taken into consideration that the coconut palm is perennial, and that its economic life may exceed 60 years, the advantage of planting selected seed is evident. Although it must not be assumed that nuts from a high yielding palm will produce high yielding progeny under all conditions, properly conducted selection should result in the establishment of a better stand of palms likely to give satisfactory returns.

Work on the production of a pure strain of high yielding palms is at present in progress at the Government Coconut Station, Klang, but results from this work are not likely to be available for a considerable number of years. It should be noted that there is no "short cut" towards the production of high yielding palms, by vegetative propagation.

The methods adopted by Mr. A. C. Smith, the writer of the article on practical seed selection of coconuts included this number of the Journal, are considered likely to give satisfactory results, in the light of present knowledge, since they are applicable on a commercial scale, and it is hoped that this account of a practical scheme, which marks a definite advance in coconut planting methods, will be informative and helpful to those interested in the coconut industry.

Original Articles.
DISEASES OF POULTRY AND NOTES
ON POULTRY REARING.

BY

H. D. MEADS,

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Disease is one of the most acute problems which besets the poultry keeper in all parts of the world and hitherto the information concerning it which has been generally available in Malaya has been remarkably inadequate.

Indeed, the belief that the mortality of poultry is generally attributable to only one form of disease is not uncommonly held in this country, whereas in actual fact there are at least six diseases which are the frequent cause of heavy loss of life.

In the case of the majority of the more serious poultry diseases, particularly those caused by specific micro-organisms which attack the intestinal tract and whose common symptom is acute diarrhoea, prophylactic measures alone are recommended, together with the immediate isolation and destruction of affected subjects. No reliance can be placed on the use of medicinal cures for such diseases; it remains only for the poultry keeper to endeavour to maintain the health of his flock through careful feeding, housing and sanitation, and to maintain rigidly a constant observation of all birds so that individuals showing signs of illness may be segregated at an early stage, thereby lessening the chance of a rapid spread of infection.

The importance of an early recognition of symptoms cannot be too strongly emphasised, and for such recognition it is essential that a knowledge of the common poultry diseases be acquired.

An effort has been made to compile the information contained in contemporary publications of other countries on the subject of such diseases of poultry as are of known or suspected occurrence in Malaya.

For the purpose of assisting in their recognition these ailments are grouped into those of the intestinal tract, diseases of the digestive tract, diseases of the respiratory organs, and external parasites. Notes on the treatment of wounds and fractures, general sanitation, housing and feeding are also included.

DISEASES OF THE INTESTINAL TRACT.

Intestinal diseases, other than constipation, may be caused either by bacterial or protozoan organisms or by worms. In the case of infection by micro-organisms, bacteriological examination alone can determine which is responsible.

Constipation.

This is commonly caused by errors in diet such as too heavy grain or dry mash feeding or insufficient green food. Droppings are abnormally dry, and when excreting there is a noticeable straining on the part of the bird.

Treatment :—Treatment consists in the regular monthly administration of epsom salts at the rate of 2 ozs. per 25 birds dissolved in half a gallon of drinking water or added to the wet mash.

Simple Diarrhoea.

By this is meant the frequent passing of liquid droppings not caused by any infectious organism. Decomposing food, foul drinking water, unsuitable diet, such as an excess of meat or fish constituents, or exposure to cold and the presence of worms in the intestines are among the most frequent causes of simple diarrhoea. This condition predisposes the subject to infection by specific intestinal organisms and should therefore be guarded against, and treated immediately on its occurrence.

Treatment :—The treatment which is recommended is the administration of sulphocarbolates of calcium, zinc and sodium in equal proportions, five grains of which mixture is dissolved in a pint of water supplied as a drink or mixed with the mash. Potassium permanganate, 1 oz. to 4 gallons of water is also of use as an intestinal disinfectant. The supply of soft wood-charcoal, broken into small pieces the size of a pea, in a receptacle to which the bird may have constant access, is also indicated for diarrhoea and digestive disorders.

The poultry keeper should be warned, however, that since diarrhoea is a symptom of the virulent and infectious intestinal diseases, the behaviour of any affected subject should be carefully watched for any accompanying symptoms of general ill health, and the bird should be immediately isolated from the flock if any such symptoms appear.

Bacillary White Diarrhoea of Chicks.

This disease is of common occurrence in Europe, America and Mauritius, and although bacteriological examination, which is essential for its diagnosis, has not been carried out in Malaya, it is believed to be present in this country.

It is primarily a disease of young chicks. Birds which survive the disease generally carry the infection in their ovaries as adults, and can transmit it to their progeny by means of infected eggs. The disease is also disseminated through the agency of the droppings of carrier birds.

Symptoms :—Newly hatched birds from 1 to 4 days old are the most susceptible to this disease, and when a number of chicks in a brood are seen to be suffering from diarrhoea, with a white or yellowish coloured excrement, and have a drowsy appearance and a drooping carriage of the wings, the presence of bacillary white diarrhoea should be suspected.

Treatment:—It is strongly recommended that all such birds should be destroyed immediately, since not only is the rate of mortality very high but, as above mentioned, the survivors are likely to be carriers of the disease and therefore a source of danger to the flock.

In Europe it is advocated that all the stock birds should be tested by bacteriological examination in order to determine and destroy those which are the source of infection, but in Malaya, where such facilities are not at present available, it would be well to destroy any hen which is seen to rear infected broods.

Healthy birds which have had access to the contaminated pen should be moved on to clean ground and the infected pen should be dressed with quicklime and left vacant for at least one month. Houses and utensils which have had contact with diseased birds should be sterilised with a strong disinfectant.

Although the use of intestinal antiseptics is recommended by some authorities, these should not be regarded as curative but merely as prophylactic measures. In flocks where bacillary white diarrhoea has made its appearance, healthy birds may with advantage be given a solution of 5 per cent. sulphate of iron and tincture of catechu* in the proportion of one teaspoonful to 2 pints, in their drinking water on alternate days for a period of 2 weeks whenever cases of bacillary white diarrhoea or allied diseases have made their appearance.

Fowl Typhoid.

This highly infectious intestinal disease, which is also caused by a bacterial organism, is said to be world-wide in its distribution. It is seldom found to attack any but adult birds. The organism is voided in large numbers by infected birds and is transmitted by contact, contaminated drinking water and food containers, and by infected ground.

Symptoms:—Loss of appetite, a tendency to mope, drooping of the head and wings accompanied by the passing of liquid sulphur-coloured faeces are the general preliminary symptoms of this disease. As the disease advances the bird may become partially comatosed with the head fallen forward and the beak touching the ground, eventually the affected subject lies on its side with the head curved under the breast. The face, comb and wattles are pallid in colour and the body of the bird is unduly hot to the touch owing to its high temperature. Death generally supervenes after 3 to 4 days of coma.

Treatment:—All suspected individuals should be isolated as soon as the above symptoms are observed, and it is advisable to destroy all such birds immediately after the death of any of their number and burn or bury deeply all carcasses. If possible, healthy birds should be removed to clean ground while contaminated runs are dressed with quicklime at the rate of about 1 ton per half acre. All houses and utensils must be cleansed with a strong disinfectant. It is advisable to administer epsom salts to the flock.

* Tincture of catechu:—20 parts cube gambier, 5 parts cinnamon bark, 100 parts alcohol (45 per cent.).

Fowl Cholera.

Although this bacterial disease is rare in Great Britain, it is not infrequent on the Continent of Europe and in America, it is also known to occur in Mauritius, and at least one case has been definitely diagnosed in Malaya.

It is highly infectious in its nature and may attack almost all types of domestic birds. It is communicated by the droppings which infect the soil and pollute the drinking water and food. The bacillus does not form spores and is easily destroyed by disinfectants or exposure to air. Fowl cholera causes a very high rate of mortality and its incubation period is seldom longer than 24 hours.

Symptoms :—Diarrhoea may not appear in the early stages of this disease, but when it manifests itself the droppings are liquid, yellow or greenish in colour and highly foetid. The progress of the disease being very rapid, death often supervenes with great suddenness and without warning. Birds may be found dead which an hour earlier appeared to be in perfect health. In cases where sudden death does not occur, the affected subjects appear very dispirited and there is a marked tendency to remain motionless with the feathers erected and the wings, head and tail drooping; when walking, the bird's gait is very unsteady. Congestion of the comb and wattles, which take on a violet colouration, is a characteristic symptom which is rarely absent both before and after death. The lungs are frequently affected, this being manifested by raucous breathing which is easily audible from a little distance.

Treatment :—Since this disease is a very infectious one, poultry yards being, not infrequently, entirely depopulated by it in a period of from 2—3 days, it follows that the strictest precautions are necessary the moment its incidence is suspected. The immediate removal of all healthy birds from infected ground and the careful disinfecting of all houses and utensils is of the utmost importance in checking the spread of this disease. The carcasses of all dead birds must, of course, be destroyed by burning or else be buried deeply in the soil in a distant locality. The range should, if possible, be changed and the healthy birds given epsom salts; an intestinal disinfectant, such as described earlier, should be added to their drinking water.

Coccidiosis.

One further disease of the intestinal tract caused by the attack of a micro-organism, which is described hereunder, is due to the presence of a species of protozoon, the accurate recognition of which again calls for microscopic examination.

This disease is the cause of considerable mortality in young chicks but in adult birds it is more commonly a chronic condition.

Since this disease is of extremely frequent occurrence in Mauritius there is every likelihood of its being present in Malaya.

From the similarity of its symptoms in chicks it is frequently confused with bacillary white diarrhoea. The only distinguishable feature is the fact that, in coccidiosis, death does not generally occur before the seventh day after hatching, whereas in bacillary white diarrhoea, mortality is at its highest among birds of from 1 to 4 days old.

Evidence that this disease can be passed to the chick through the egg, as in bacillary white diarrhoea, is lacking. Infection is spread by contamination of the soil by adult carriers or by a previous infected brood.

This protozoon, which forms egg bodies, is not communicable at the time it is evacuated by the bird but after a few days of ripening becomes active once more. Spores of coccidiosis can remain dormant in the soil for very long periods.

In consideration of the fact that an infected bird evacuates great numbers of egg bodies of coccidiosis daily, it will be realised that runs become rapidly contaminated and it is of primary importance that the isolation of such infected ground be undertaken without delay.

Symptoms.—Similar general symptoms of ill-health are observable in this as in other intestinal diseases, that is to say, the bird becomes listless and disinclined to move about. Diarrhoea, which does not generally commence until within four days of the onset of the disease, is liquid, glairy and often tinged with blood. General weakness increases until the bird is unable to move without falling. The death rate is generally at its highest on about the tenth day after the chick's emergence from the egg. Such birds as do not succumb by the fifteenth day usually survive but their development is considerably retarded by the effects of the disease.

Treatment:—The only measure which can be recommended is the immediate destruction of all affected birds as soon as the presence of coccidiosis is suspected.

General Prophylactic Measures for Intestinal Diseases.

1. No eggs should be used for hatching except those which come from birds of proved good health.
2. All eggs should be set under healthy birds and on clean freshly dried grass or similar material.
3. The materials used in the nest box should be renewed whenever they become soiled.
4. Young chicks should be reared on ground to which no adult bird, other than the parent hen, has access, the soil having been first disinfected with a suitable preparation such as a solution of tuba root—1 lb. to 10 gallons of water—or with boiling water.
5. Drinking water and food must be kept in receptacles so placed that birds cannot enter and foul them.
6. All houses should be cleansed once a month with a solution of disinfectant, such as "Izal", $\frac{1}{2}$ oz. to 1 gallon of water.

7. The administration of an intestinal disinfectant, in the drinking water, such as has been earlier described, is to be recommended at intervals of about a fortnight.

8. The flock must be carefully observed daily for any signs of ill health.

9. Immediate isolation of all birds suspected of being infected with an intestinal disease is of the greatest importance.

10. Birds which are observed to suffer from an acute affection of the intestines and exhibit any of the symptoms already described, should be destroyed and their carcasses be burnt or buried deeply.

11. Ground to which diseased birds have had access is certain to be infected with the causal organism and healthy birds should not be allowed entry to such areas. Infected ground should be allowed to lie fallow for several months and if possible be treated with quicklime.

12. It must be remembered that errors in diet predispose the intestinal tract of poultry to the attack of disease germs, therefore correct diet does much towards reducing the occurrence of disease.

Intestinal Worms.

There are several species of intestinal worms which parasitize fowls. When numerous, these worms may interfere with digestion and nutrition producing stunted growth and loss of weight and even, in young birds, not infrequently causing death. Since the eggs of worms are passed out of the body of their host and are readily picked up by other birds, the importance of isolating newly hatched chicks from adults will again be perceived.

Symptoms :—Indolence, lack of appetite, loss of weight, diarrhoea and an unkempt appearance of the plumage are common signs of the presence of worms. The progress of the affection is slow but careful observation will disclose parasitized birds in time to allow of a cure being effected.

Treatment :—One teaspoonful of epsom salts dissolved in warm water before mixing with a very small quantity of mash, should be allowed per bird and given in the evening. On the following morning turpentine mixed with an equal quantity of olive oil should be poured into the mouth in a dose of from 1 to 2 teaspoonfuls per bird, according to age. This is particularly beneficial in cases of tape-worm parasitization.

An alternative treatment is to mix oil of chenopodium with a moist mash feed at the rate of one teaspoonful of oil for every 12 birds.

Tobacco is also recommended as a reliable cure and may be employed in the following manner :—2 ozs. of finely chopped dried tobacco leaf for every 12 birds should be steeped for 2 hours in sufficient water to cover it and the whole should be mixed with half the usual ration of mash. This treatment should be repeated after the lapse of 10 days.

All vermifuges are more effective if administered when food has been withheld on the day previous to treatment.

A few hours after the birds have been given a vermifuge, a solution of epsom salts, should be given in the manner described above.

Since the foregoing vermifuges are poisonous it is as well to test their effect on a few birds before administering to the entire flock.

Prophylaxis:—The eggs of intestinal worms are voided from time to time by infected subjects, and, in cases where their prevalence is found to affect seriously the health of the flock, it is advisable to remove birds to a fresh plot of ground wherever possible, and to allow the infected area to lie fallow for 1 year or more, or to dig up and remove the surface soil.

Crop Binding.

Crop binding is not a disease but a purely mechanical affection of the alimentary tract.

Birds in which the crop has become so overloaded and swollen, owing to its exit being totally or partially stopped, as to cause considerable discomfort should be treated as follows:—The bird is held by the feet and the crop gently but firmly massaged with the fingers until such liquid as has accumulated in the crop is expelled from the mouth. The bird should then be enclosed in a separate coop and fed only on soured milk for two to three days. Milk may be soured by addition of a small quantity of rennet: sour milk has the effect of dissolving fibrous material which blocks the exit of the crop and forms at the same time a nutritious diet for the bird.

If the obstruction is of a non-fibrous nature a surgical operation will be necessary.

Crop binding is most frequently caused by swallowing lengths of hard fibrous grass, therefore all grass to which the birds have access, more particularly in the case of young chicks, should be cut into short pieces.

DISEASES OF THE RESPIRATORY SYSTEM.

Roup.

This infectious disease is a form of catarrh, characterised by a foetid discharge from the nasal passages which eventually become gummed up by mucus. In acute cases roup can become fatal.

Chills due to damp and draughty houses are predisposing causes of roup.

Symptoms:—Sneezing, inflamed eyes accompanied by swelling of the face just below the eyes and laboured respiration through the mouth are indicative of roup. The affected bird has a depressed appearance, rough plumage and is lethargic in habit.

Treatment:—Affected birds should be isolated and all houses and yards disinfected. The flock should be watched for further incidence of the disease.

The nostrils of diseased birds should be syringed with a solution of bicarbonate of soda in the proportion of half a teaspoonful to a teacup of warm

water. The bird's head should be held downwards and the liquid forced through the nose until it is expelled from the mouth. This should be followed by a further warm injection of eucalyptus 30 drops, thyme oil 30 drops, menthol crystals 10 grains, oil petrol 2 ozs. The treatment should be repeated three times a day accompanied by epsom salts in the drinking water* and a soft diet.

Broncho-Pneumonia.

This affection of the lungs is of most common occurrence among birds which are slow in forming plumage such as the Malayan, Plymouth Rock and Orpington breeds. Unhealthy conditions such as dampness and draughts are the usual cause of broncho-pneumonia.

Symptoms :—Partial or total loss of appetite accompanied by constipation and thirst. The bird tends to stand apart from the flock with ruffled feathers and has a very noticeable difficulty in breathing. The affected bird coughs occasionally in an effort to clear the air passages. Death supervenes rapidly.

Treatment :—Isolation of the affected subject is not essential since the disease is not infectious, although until its diagnosis is determined it is as well to remove sufferers from the flock: this moreover facilitates treatment. Nasal injections similar to those described for roup are advised with the addition of a teaspoonful of a mixture of equal parts of pulverised ginger, brandy and honey with 1—2 grains of quinine sulphate and 2—5 drops of ipecacuanha or 1-2 drops of tincture of iodine.

Fowl Pox or Avian Diphtheria.

It has been found in Mauritius that all breeds of poultry are not equally susceptible to this disease, the local and Malayan types being comparatively immune.

Fowl pox, which is a contagious affection of the mouth, nose and eyes is to be distinguished from roup by the fact that lesions are formed on the membranes of these organs and/or on the comb and wattles.

It has been proved that there are no "carriers" of fowl pox, therefore the introduction of the disease may be prevented by the isolation of any new additions to a flock for a period of 1 month, during which time the comb and mouth should be examined for any signs of fowl pox lesions. The disease is only transmitted through direct contact on a portion of abraded or wounded skin.

Symptoms :—General preliminary symptoms of ill health accompanied by sneezing or an occasional cough are followed by the formation of greyish or yellowish membranes in the mouth and throat, or by a purulent discharge from the nose and eyes with a glueing together of the eyelids.

* The following internal disinfectant is beneficial in the treatment of colds and roup :—1 oz. of copper sulphate is crushed and dissolved in 19 ozs. of water, the clear liquid is decanted and used in the proportion of 1 teaspoonful to 1 gallon of drinking water,

In the later stages of the buccal form, the false membranes develop to such an extent that the bird is unable to close its mouth; the accumulation of lesions at the opening of the trachea causes death from suffocation generally within two to three weeks from the onset of the symptoms.

When the comb and wattles alone are affected, wart-like nodules appear on the featherless skin of the head. If this form of fowl pox does not spread to the mouth, the bird's general health is not affected and it may recover within from two to four weeks.

Treatment :—Although in Europe a vaccine for the prevention of fowl pox has been discovered, this preparation is not at present available in Malaya.

There are no methods of economical treatment which can be recommended. The disease invariably spreads slowly and can easily be eradicated from a flock if affected birds are destroyed while the disease is in its early stages and disinfection, together with careful observance of all contacts, is carried out.

Gape Worms.

These are a frequent source of mortality in young birds up to 3 or 4 months old. The symptoms, which do not appear until the bird has been infected for ten days, are a cough or sneeze with frequent shaking of the head followed by a stretching of the neck with the beak open in an attempt to take in more air.

It should be noted that this symptom also occurs in cases of affections of the lungs.

These worms, which vary from $\frac{1}{5}$ in. to 1 inch in length, and are bright red in colour, attach themselves to the lining of the wind pipe and can be frequently seen if the bird, with its beak open and neck outstretched, is held up to the light. The worms may eventually cause death from suffocation by obstruction of the passage.

Adult fowls seldom if ever succumb to the effect of this worm as the birds are able to expel the parasite by coughing.

Treatment :—It is advisable to kill and burn the carcasses of all young chickens which are attacked, in order to avoid the spread of the worm from dissemination of its eggs. All birds should be immediately removed from an infected pen, and the ground should be disinfected with a solution of tuba root or other insecticide in order to destroy the earth worms which are considered to be hosts of the gape worm. There are various mechanical methods for removal of worms from the wind pipe but these cannot be recommended as being very satisfactory.

As has already been stated, older birds should never be kept in a pen with young chickens, as they are liable to infect the latter not only with gape worms but with many other parasites and diseases.

EXTERNAL PARASITES OF POULTRY.

Favus or White Comb.

This disease is due to a fungoid parasite which primarily attacks the comb and other featherless parts of the head. It is highly contagious and spreads rapidly in a flock. The disease can be transmitted to human beings and this should be borne in mind when treatment is undertaken.

Symptoms.—Small irregular spots form on the comb or wattles which later coalesce into a yellowish grey crust. When the feathered areas of the head and neck become involved the disease usually ends fatally.

Treatment.—Immediate isolation should be carried out. The affected parts should be bathed with warm water and soap, fomented, the crusted patches being removed as far as possible with a blunt-edged instrument, and smeared with sulphur ointment or an ointment of 5 per cent. nitrate of silver in vaseline. Any bird on which the disease has spread to the feathered parts before treatment is undertaken should be destroyed.

Insect and Mite Pests.

Fleas, bugs, lice, ticks and mites are pests which attack poultry. Those which suck blood are the cause of debility and the biting insects are a source of constant irritation and restlessness. The portions of the body most favoured by these parasites are the head, neck, rump and under the wings.

One type of mite is often the cause of feather eating, as the bird pulls out the quills in an endeavour to alleviate the irritation.

Control Measures for External Parasites.

Absolute cleanliness of the birds' quarters and nest boxes is essential for the control of these pests. Apart from the routine cleaning of droppings and other dirt, fowl houses should receive a thorough cleansing at least every six months when all moveable parts should be taken out and scrubbed with a strong disinfectant such as 5 per cent. Izal or Lysol solution the walls and floors being washed with a similar solution.

An emulsion of paraffin (3 parts soft soap in 15 parts hot water and 70—100 parts paraffin added gradually while stirring) is very efficient as a spray for houses infected with insect pests.

Parasitized birds may be dipped in a solution of tuba root (1 lb. to 10 gallons water) the feathers being manipulated by hand to allow of the solution reaching the skin. A hot day should be chosen for the carrying out of this treatment to enable the birds to dry quickly.

WOUNDS AND FRACTURES.

Wounds should be washed in water and treated with tincture of iodine. Wounds of birds, unless very serious, generally heal with great rapidity.

In cases of fracture of the leg the broken bones should be placed in perfect apposition. A thin layer of cotton should be bound round the leg, care being taken that the circulation is not interfered with, and three wooden splints of the requisite length applied and fixed in position by a bandage saturated in glue, which, after hardening, holds the parts firmly in position. The injured bird should be confined to a small solitary run for fourteen days, after which the bandage may be removed.

The bird should remain confined for a few days longer before rejoining the flock.

THE MOULT.

Although the moult is a normal and not in any way a disease condition, in consideration of the fact that it is a period during which poultry is particularly susceptible to illness it is thought that remarks on their care during the moulting season will not be incompatible with the purpose of these notes.

The feathers contain some 4 to 6 per cent. of nitrogen and a high proportion of phosphorous and other minerals which are derived from the food; it follows therefore that such minerals should be provided by a full and carefully balanced ration during the period of refeathering. An unsuitable diet has the effect of prolonging the period of the moult, thereby increasing the period when the bird is most vulnerable to the attack of diseases, more especially those of the pulmonary system. Adult birds are particularly susceptible during this season, and it is essential to ensure that their housing is dry and free from draughts and that their food supplies the necessary nourishment.

It is recommended that a pinch of sulphur sublimite or iron sulphate per bird be added to their drinking water, or sulphuric acid in the proportion of 1 dram per pint of water.

The protein content of the feed should be raised during the moulting season by increasing the proportion of fish, meat and vegetables.

NOTES ON GENERAL SANITATION.

It has already been stated that no reliance can be placed on any medicinal cures for poultry diseases; it should therefore be the object of all poultry keepers to assure that conditions conducive to ill health are avoided. Dirt, damp, draughts and poor feeding are the principal factors which predispose birds to the incidence of disease. Well drained, undulating soil of a sandy nature is

the most suitable for a poultry yard. Dry, draught-free houses, of adequate size in which the ground is raised above the general level, the flooring being removable and where all parts are readily accessible for cleaning, are essential.

Housing.

In deciding upon the type of house to be erected due regard must be made to the position in which it will be placed. The type of house which is suitable for an exposed position would probably prove too stuffy if placed in a sheltered situation, while the converse of course is also true. The suitability of a house must be decided by observation of the fowls and alterations made accordingly if found necessary.

The behaviour of the birds at night is a good indication of the efficiency or otherwise of the ventilation. If the birds are seen to huddle close together in groups it is a sign that they feel cold and the house is either damp, draughty or both: if they space themselves evenly on the floor or perches it indicates that the ventilation is suitable. With efficient ventilation there is practically no smell noticeable on opening the fowl house in the morning.

The floor space allowed per bird in the house will depend upon whether additional day shelter is provided. If the house is only to be used for sleeping it may be much smaller than if it is their only shelter. For a house used solely for sleeping purposes $1\frac{1}{2}$ to 2 sq. ft. of floor space per bird is required, while if the house is to be used by fowls in the daytime also, the allowance per bird should be increased to 3—5 sq. ft. or more per bird.

If permanent fowl houses are erected, it is desirable that the walls and roof should be as smooth as possible to facilitate cleaning.

If perches are provided they should all be on the same level otherwise there is perpetual quarrelling amongst the birds owing to competition for the highest perch. Perches should be of wood, two inches square, with rounded top edges. They should not be nailed in position but tapered at the ends and fitted into tapered slots. This arrangement while keeping the perch quite firm, allows it to be readily removed for cleaning should the red mite make its appearance. The length of perches should be from 6 to 12 inches per bird according to size of the birds.

A droppings board, covered with sand or dry powdered earth, should be fitted six inches or more below the perches. The droppings should be removed daily.

NOTES ON FEEDING.

While systems of feeding poultry are numerous, it may confidently be asserted that there is no one method that can claim to be correct to the exclusion of others. Local conditions must be considered and the greatest use of inexpensive foodstuffs be made.

Feeding of Free-range birds. Birds which are kept on a free range, as in Malayan kampongs, require smaller quantities of artificial feeding stuffs than

birds which are confined to pens. Grubs, insects and worms will to a great extent fulfil the birds' meat requirements and the natural green-food available to them is not likely to need augmenting.

Birds kept on a free range might with advantage be supplied with a wet mash in the morning, such as is described below. Grain feed, as in the subsequent paragraph under this heading, must of course be given to them in the evening.

Wet mash is fed to poultry in a limited quantity which should be consumed by the birds within half an hour.

Among the ordinary constituents of kitchen refuse which may with advantage be given to poultry in the form of a wet mash are fish heads, tails and bones, scraps of meat and meat bones, parings of vegetables, cabbage, lettuce and spinach leaves and the bud or "umbut" of the banana stalk removed after fruiting. The fish and meat materials, after the removal of all fat, should be boiled* and then minced or broken up by pounding and mixed with from 10 to 15 times their weight of bran, cooked rice or stale bread crumbs and fed to the birds from a trough. If salt fish is used it should be soaked in hot water just before it is required in order to remove the salt. All vegetable remnants should be placed in cold water until required and only chopped up immediately before feeding. In the case of fibrous vegetable material, care should be taken to cut it into small pieces to prevent the birds from becoming crop-bound by portions of long hard fibre. No stale or decomposing vegetable or animal matter should ever be given to the birds as such is conducive to stomach trouble.

The fat removed from meat remnants should be melted and poured over bran or rice refuse and carefully mixed. This addition of fat is only suitable for young stock, which have a poor growth of feathers, birds which are being fattened for the table or for moulting birds. An excess of fat reduces fertility of the eggs of breeding birds as well as the egg production of layers.

Feeding of birds kept in runs :—Although there are many standard works on intensive poultry feeding in other countries, it is considered that their recommendations if adopted in Malaya might prove too expensive to be profitable.

The importance of a correctly balanced diet is obvious if the best results are to be obtained.

Experience in Malaya has proved the following system of feeding to be very successful :—

1. A dry mash placed before the birds in sufficient quantity for consumption during the day.
2. An evening feed of grain because this needs longer time for digestion and the birds retire satisfied at night.

A dry mash which is composed of several foods, must be given to the birds well mixed and in a fine state of division. If it is not in a finely

*Boiling is only recommended for such materials as cannot readily be mixed otherwise, since the cooking of food may lessen its nutritive value.

ground condition, the birds will pick out such portions as they prefer and so fail to get the balanced ration. The work of grinding is facilitated if all materials are well dried beforehand.

Finely ground foods should not be kept for any length of time as they lose a certain amount of their value and decompose more rapidly. When it is found advisable to prepare a small stock, the finely ground food should be dried in the sun for two or three days before storage. Mash can be ground up either between granite stones or in a large coffee mill.

Mashes should always be fed to the birds in troughs and never on the ground. The trough in which dry mash is provided throughout the day must be protected from the rain, and should have wire partitions to prevent the birds from entering the trough and fouling its contents.

The following dry rations, in parts by weight, have been found to be successful for poultry in this country :—

For young chicks.

- 11 parts padi, ground fine, husk discarded :
- 4 parts soya bean cake or groundnut cake, ground fine :
- 4 parts whale meat meal :*
- 3 per cent. of total (by weight) minerals (3 parts steamed bone flour, 1 part salt, 1 part powdered oyster shell)
- 2 per cent. of total (by weight) red palm oil.† (This should be added after the other constituents have been ground and mixed).

For growing chicks.

- 23 parts padi, ground, husks discarded :
- 3 parts soya bean or groundnut cake :
- 3 parts whale meat meal :
- 2 per cent. of total (by weight) minerals (as above) :
- 1 per cent. of total (by weight) red palm oil.

For laying hens.

- 4 parts padi, ground, husks discarded :
- 2 parts soya bean or groundnut meal, ground :
- 1 part whale meat meal :
- 2 per cent. of total (by weight) minerals (as above) :
- 1 per cent. of total (by weight) red palm oil.

The dry mash, as previously stated, is kept before the birds all day.

In addition to the above dry mash systems a limited quantity of wet mash, such as is described in an earlier paragraph, may be supplied to the birds in the morning.

* Supplies of whale meal can be obtained locally in 7 lbs. tins and 28 lbs., 1 cwt. and 2 cwt. bags. When ordering, it is essential to state if it is required for poultry feeding so that only fresh meal be supplied.

† Red palm oil which is stated to be richer in Vitamin A than the more expensive cod liver oil is particularly beneficial in strengthening the pulmonary system of poultry.

Grain.—Padi which must be fresh and free from moulds, should be supplied to the birds in the evening at the rate of about $1\frac{1}{2}$ to 2 ozs. per bird, or in an approximately equal weight to that of the total dry weight of mash actually consumed during the day, part in a trough and part scattered on the ground.

For feeding to young birds all grain should be broken to a suitable size as the birds are unable to husk it for themselves.

Green gram, or kachang hijau, is greatly liked by poultry and can be mixed in the proportion of 1 part to 5 parts of padi. The grain feed must be supplied in definite known quantities as this diet can be used to regulate the condition of the birds; thus if they show a tendency to become too fat, the evening grain ration may be increased, when the birds will be found to require less mash during the following day. Similarly if the birds are required to put on flesh the grain supply should be reduced and the mash feed increased proportionately.

Testing the Fatness of Poultry. It must be borne in mind that both under-nourished and over-fed hens cease to lay.

An under-nourished hen is over-eager with food and its breast bone when felt forms a projecting ridge with little flesh covering it.

The best method of testing the fatness of a bird is to hold it with both hands facing towards one, sliding the right hand along the ribs until the tips of the fingers rest on the abdomen just below the breast bone. In a thin bird, a hard lump about the size of a nutmeg, which is the gizzard, will be easily felt, whereas considerable pressure will have to be exerted on a fat bird before the gizzard is located. The handling of birds should preferably be carried out after dark with the aid of an electric torch, the birds being disturbed as little as possible.

Drinking Water.

Birds should have access to fresh, clean water at all times; dirty water is a frequent source of introduction of various diseases of poultry.

Drinking water should be replenished at least twice a day, being placed in receptacles that are thoroughly cleaned daily and kept in a shady situation.

It is preferable to supply drinking water to fowls in glazed earthenware receptacles rather than in metal ones, more especially when chemicals are to be added to the water.

Mineral Supply.

The necessity of providing poultry with an adequate supply of lime for shell production, and of grit to assist digestion, is obvious and has long been recognised. It has been proved that mineral deficiency is the cause of certain ailments in poultry.

Grit is necessary to poultry and replaces the action of teeth in reducing grain and other food in the crop to a sufficiently fine state so that the nourishment can be absorbed by the digestive organs. The grit should be hard—the harder the

better—and have sharp angles. A stone which readily breaks into thin flat flakes should be avoided as it is liable to cause internal wounding. Sand, which can be washed on ordinary wire “mosquito” netting so that the small particles and earth are extracted, is readily obtainable in Malaya and will be found satisfactory.

Poultry obtain a certain amount of lime from their foodstuff, but in many parts of Malaya, where the soil may be deficient in lime, it is probable that the birds will obtain an inadequate supply resulting in thin or soft-shelled eggs.

Broken oyster and other shell, sand or limestone are the more usual alternative sources of lime for feeding to poultry. The choice of the particular source of lime will, therefore, depend upon that which is most readily procurable.

It should not be forgotten that certain waste products are suitable for use in this connection *e.g.* unburnt stone from lime kilns, old mortar from buildings. *On no account should unslaked burnt lime be given to poultry.*

A suitable mineral mixture, which may be used alternatively to that described on page 262, and added daily to the dry mash, is one of equal parts of lime, salt and charcoal of which 1 to 3 per cent. (by weight of the entire mash) should be mixed with the mash. Salt must be always used with caution as 3 per cent. of salt is generally fatal to poultry.

In conclusion it may be said that while suitable diet and good sanitation cannot be expected to immunize poultry from disease, which may be introduced by various means, much can be done towards minimising the effects of disease.

Constant observation of the flock, and immediate removal and destruction of birds which are suspected to be suffering from any infectious disease, will help to prevent the loss of an entire flock, a happening which is a not infrequent experience of the poultry keeper in Malaya.

ACKNOWLEDGMENTS.

The foregoing notes have been compiled from information contained in the following publications:—

“Some Diseases of Poultry”, Bulletin No. 6. Published by Ministry of Agriculture and Fisheries—London.

“Notes sur l' Elevage des Oiseaux de Basse-cour et du Lapin”, by Donald D' Emmerez de-Charmoy, I.S.O., Assistant Director and Entomologist, Department of Agriculture, Mauritius.

“Poultry Diseases”, by R. F. Kaupp, B.S., M.S., D.V.M. Published by Baillière Tindall and Cox, London.

The sections on housing and feeding are based on information supplied by Mr. W. H. Barnes, formerly Agricultural Field Officer, Negri Sembilan.

PRACTICAL SEED SELECTION OF COCONUTS.

BY

A. C. SMITH.

In the past the selection of seed for the planting of the main commercial areas of tall coconuts in Malaya appears to have been carried out on what, at the best, must be termed haphazard lines. This grants that, in most cases, planters have done their utmost with existing facilities to obtain the best planting material on offer.

In no branch of agriculture is good seed expensive, be times good or bad, and this is particularly the case with perennial crops with a long economic life—coconuts for example which normally remain profitable for a period of 30 to 60 years. In a crop of this nature planting is done once and for all, the use of poor material cannot be rectified in the following year as is the case with annual crops. The planter must stand upon the seed he provides in the first instance, therefore the expenditure of a few dollars more per acre on the best possible material is of little moment. Expressed in terms of cash one looks upon the difference between seed cost of \$5 and \$25 per acre on a 1000 acre estate as vast, but if by provision of improved seed, yields can be obtained only 10 per cent. above average, say from 10 to 11 piculs of copra per acre, the cost plus interest is fully recouped in 7 or 8 years—less than one quarter of the economic life of the palm—even with copra at \$5 per picul.

Three methods of seed selection appear to have been used on the European owned coconut areas of Malaya.

- (1). In the older (pre-1900) plantings, by purchase from any mature estates or kampongs which had some reputation for yields and which were so situated as to afford reasonably cheap transport.
- (2). By mass collection from known high yielding estates or areas.
- (3). In a few cases from selected heavy cropping palms in known high yielding areas.

Each method marks a definite step forward but it cannot be said that great progress has been made. It cannot be denied that in respect of this problem the coconut industry lags behind most other large scale tropical products. Rubber, a much newer commercial agricultural proposition, has made enormous strides during the past 10—12 years, whereas coconuts have practically nothing to record. The reason for this is undoubtedly the time involved in evolving and proving a pure strain—probably two generations or about 25 years. There is unfortunately, no short cut by vegetative propagation as in the case of rubber, but as coconuts have been established as a commercial proposition for upwards of thirty years in Malaya, the industry should by now be far ahead of where it actually is, and it must be admitted that very little energy has been applied to this most important yield factor.

Of the methods enumerated above, (2) is that most frequently used but at best it can only be expected to provide plants which will return good average yields. Examination of any high yielding area will establish the fact that the variation in yield per palm is from 0 to over 120 nuts per annum, with more than 50 per cent. of palms below average.

(3) is an improvement upon (2) but in most cases selection is confined to palms carrying heavy heads of nuts without due regard to copra content. Even where selection is carried a step further to handling and opening nuts from such palms for inspection of meat content, the margin of error is very large. Detailed examination of ripe nuts from 47 palms, all with a wet meat content of over 600 grammes, showed a variation in meat thickness between 10.5 and 15.5 mm. with the main group lying between 12.5 and 13.5 mm. Inspection of two nuts of approximately equal size with meat thickness of 12.5 and 13.5 mm. will indicate the difficulty of judging meat content by casual observation, yet the difference is no less than 8 per cent. An increase or decrease of 1 mm., although it has a very large bearing upon copra yield, is almost impossible to detect by eye alone.

Very detailed examination of palms and their nuts for seed purposes is, although laborious, well within the capabilities of any planter, and it requires no scientific training or special plant. From the writer's experience 600—700 palms can be examined and possibly marked in two to two and a half hours, and this is about as much as should be attempted at any one time; it is very tiring and one's power of observation flags towards the end. Where an area of palms returning yields well above average is available on an estate, the advantages of taking seed from such an area for extensions or replanting are manifest. The primary advantage is that environmental conditions are suitable, palms doing well on one part of an estate should do well elsewhere in the same area, assuming that there is no great difference in soil and drainage conditions. There is no guarantee that seed from high yielding palms on the free undulating soils of say Penang Island would do equally well on the flat alluvial clays of the Lower Perak District.

If seed is required for a small area, close selection is a simple matter, but, if a clearing no larger than 100 acres is to be planted, it will be necessary to scour a fairly wide area to obtain a sufficient quantity of the required standard. Seedlings are usually planted out fairly early in the rainy season, and to obtain sturdy plants of even growth at this time necessitates the laying down of seed for the whole area more or less simultaneously. There is undoubtedly a tendency towards economising in the number of seed nuts purchased or laid down, and in consequence one frequently notices that the last portion of a clearing contains a proportion of poor and weakly seedlings. The total seed laid down should not fall far short of 100 per cent. in excess of the number of plants required. For 100 acres planted 30 ft. x 30 ft. and, allowing for first supplying, 5000 plants are required: 9000 seed is none too many. With germination of 85 per cent.

which is rarely exceeded, the margin is only some 2500 plants, or in other words two in every three have to fulfil ideal conditions as regards growth. Using seed from palms yielding not less than 100 nuts per annum with a satisfactory copra content, not more than 35 suitable nuts will be obtained from each palm during the three heaviest cropping months. This necessitates not less than 250 selected parent palms, and as such palms, even in a very high yielding area, only amount to 3—5 per cent. of the whole stand, it entails the examination of 6000—7000 palms, or an area of 120—150 acres. If planting can be spread over a whole year it should be possible to obtain an average of about 150 nuts per acre from the selected area, or sufficient to plant up rather more than $1\frac{1}{2}$ acres per acre of the selected area.

No method of seed selection which has to contend with open pollination, and consequent hybridisation, can be described as ideal, but so far there is no available supply of seed coconuts of pure strain, at least not on the scale applicable to estate requirements when planting up large areas. Work of this nature is now being carried out by Officers of the Department of Agriculture at the Klang Experimental Station, but it will be long before a pure line is evolved and proved, two generations of coconuts or about 25 years, and then in all probability seed will not be available in large quantities. Beyond the fact that under normal conditions the tall coconut rarely if ever "selfs", and that therefore all seed must be cross pollinated, little is known of its genetics and hereditary traits. The best that can be done is to commence with an area containing a large percentage of palms yielding well above average, the chances of fertilisation from a high yielding parent being distinctly favourable. The methods adopted by the writer and described below should be the most satisfactory in the light of present knowledge and applicable on a commercial scale. Selection method (2) is fully complied with in that the area from which seed is taken returns yields far above average, and (3) is fulfilled by the close examination of individual palms, thus as far as possible ensuring good female stock.

Selected area. 80 acres.

Age. 27 years. Planted 1906.

Planting. 30 ft. x 30 ft. = 48 palms per acre.

Yields. Average 13 years 1920—1932, 3860 nuts per acre. Conversion approximately 235 nuts per picul copra = 16.3 piculs per acre. Actual stand of bearing palms 45.5 per acre = 82 nuts per palm.

Situation. All mature areas within approximately half mile radius return average yields of 3300—3500 nuts per acre.

Soil. Flat alluvial clay.

Total palms examined. 3875. Vacancies, supplies and non-bearers 153, bearing palms 3722.

Method of selection. Only palms carrying 100 nuts or more are selected as possible parents, all ripe nuts are collected from such palms and one typical specimen is selected for examination and weighing of wet meat.

Details of Palms.

Total examined	...	3875.	
„ 100 nuts and over	...	690	= 17.8 per cent.
„ 50 nuts and under	...	1109	= 28.6 „
Average of "100 nut" palms	...	117.23	nuts.

Having thus arrived at exceptionally high yielding palms as regards number of nuts, the selected nut from each was then weighed for wet meat content. The following table gives the weight outturns in grammes wet meat per nut.

TABLE I.

Over 700 grammes	...	3	=	0.4	per cent.
600/700	„	47	=	6.8	„
500/600	„	191	=	27.7	„
400/500	„	307	=	44.5	„
300/400	„	128	=	18.6	„
Under 300	„	14	=	2.0	„
		690		100.0	per cent.

These figures necessarily refer only to the 690 selected palms. That there would have been nuts from the palms carrying under 100 nuts returning both larger and smaller wet meat yields cannot be doubted. They further emphasise that the proportion of really high grade palms in a very high yielding area is very small, and that mass seed collection from such areas is unsound. Only 241 palms of the 3875 examined returned 100 nuts of 500 grammes or more wet meat, equal to 6 per cent. In any system of close selection one would never go below 500 grammes.

The general yield of estate grade copra is 50 per cent.—53 per cent. of the wet meat content of nuts dealt with. Taking the lower figure, the approximate number of nuts required per picul of copra from the several categories is therefore :—

(453.59 grammes = 1 lb.	60479 grammes = 1 picul = 133.33 lbs.)
700 grammes	= 173 nuts per picul.
600 „	= 201 „ „ „
500 „	= 242 „ „ „
400 „	= 302 „ „ „
300 „	= 403 „ „ „

A small variation in size will be found in nuts from the same palm and even from the same bunch. One nut cannot therefore be taken as a definite determination but it is the best that can be done under normal estate conditions, and if care is taken in selection, is accurate within practical limits.

The selection of nuts on wet meat content merely denotes working to a standard, dependent almost entirely upon the area available for selection and the number of seed required. If a large clearing is to be planted up, it will probably be necessary to modify the standard; if a very small area, selection can be very close and high grade planting material can be secured. In the writer's case two small clearings totalling only 15 acres were planted with nothing under 575 gramme seed, but where nuts were supplied for a 50 acres clearing in one delivery the standard had to be scaled down to 500 grammes.

It is frequently asserted that nuts of pronounced ovoidal shape should not be used as seed. Details of shape of the whole 690 nuts were recorded and it was found that there was no practical difference in meat content between oval and round specimens. Neither did colour appear to have any bearing upon the value of the nut. Red, yellow and green types all show more or less the same percentage of good and poor yielders and high and low meat contents.

Further points emerged when approximately 500 nuts from 66 palms, all over 575 grammes, were laid down in the nursery. Wide variations in germination and growth were to be expected and careful notes were kept of the behaviour of seed from each palm. These were of such interest that a second batch was laid down as a check. In almost every case the general characteristics of seed from the same mother palm were identical in both batches. The first lot was laid down in July and notes taken in November, after four months. The second batch was laid down in November and notes taken in February, also after four months. Weather conditions in each case were favourable to germination and growth. The following examples of results from the two batches may be taken as typical of the whole.

Palm No. 12. 631 gr.	November 8 nuts.	Germination 8 = 100 per cent. All strong healthy plants.
	February 8 „	Germination 7 = 87 per cent. All strong even plants.
Palm No. 29. 588 gr.	November 10 nuts.	Germination 7 = 70 per cent. Weak and irregular, only 2 good.
	February 14 „	Germination 13 = 93 per cent. Very slow and weak, only 4 fair.
Palm No. 37. 575 gr.	November 10 nuts.	Germination 10 = 100 per cent. All strong even plants.
	February 25 „	Germination 24 = 96 per cent. All strong even plants.
Palm No. 51. 656 gr.	November 14 nuts.	Germination 9 = 65 per cent. No good plants, irregular and poor.
	February 9 „	Germination 1 = 11 per cent. Useless.
Palm No. 88. 585 gr.	November 10 nuts.	Germination 10 = 100 per cent. All poor plants with malformed shoots.

	February	8	„	Germination 5 = 62 per cent. Poor, all shoots malformed.
Palm No. 122. 575 gr.	November	7	nuts.	Germination 4 = 60 per cent. Weak, irregular and poor.
	February	10	„	Germination 6 = 60 per cent. Weak, irregular and poor.
Palm No. 160. 630 gr.	November	18	nuts.	Germination 9 = 50 per cent. All very poor plants.
	February	8	„	Germination 2 = 25 per cent. All very poor plants.
Palm No. 183. 588 gr.	November	12	nuts.	Germination 12 = 100 per cent. Exceptionally strong even plants.
	February	8	„	Germination 8 = 100 per cent. Very good and even.
Palm No. 190. 594 gr.	November	8	nuts.	Germination 4 = 50 per cent. Poor.
	February	4	„	Germination 1 = 25 per cent. Useless.
Palm No. 239. 605 gr.	November	2	nuts.	Germination 2 = 100 per cent. Both malformed shoots.
	February	12	„	Germination 10 = 83 per cent. 7 malformed shoots.

On the whole, the large nuts showed a small percentage of germination and less strong healthy plants than did those of more nearly average size. There was very little difference in total germination percentage between the two lots, and in each case almost exactly 60 per cent. good sturdy even plants were obtained after five and four and a half months respectively. This indicates that it is unsafe to lay down less than 80 per cent.—90 per cent. seed in excess of actual requirements.

The data recorded in the foregoing shows that there is room for vast improvement in yields by careful seed selection provided that the female parental characteristics are transmitted in the majority of cases. As stated previously, little is known regarding this at present but at the worst one commences with female stock of high standard, and with the male parent also taken from a high yielding area, chances are greatly in favour of better yields than have hitherto been attained. Returns of over 15 piculs of copra per acre are now deemed almost phenomenal, yet with promiscuous seed supply a large area is capable of yielding over 16 piculs per acre for 13 years. This is undoubtedly due largely to environmental conditions but it indicates that potentialities are greatly in excess of standards hitherto accepted as high, if close seed selection is carried out in an area of this yielding capacity. Even if environment is rather less favourable, selection on these lines should outweigh this, and similar yields, which are much above average, should be obtainable from any area of good coconut land with reasonable drainage facilities and good cultivation. Under approximately similar environmental conditions, with selection no closer than palms yielding 100 nuts per annum with a 550 grammes wet meat content, yields of over 20

piculs per acre should be attainable. (5000 nuts per acre at 220 nuts per picul.) Of the 3875 palms examined 123, or slightly over 3 per cent., reached this standard— $1\frac{1}{2}$ palms per acre. Any high yielding area,—3500 nuts per acre or better—should return approximately similar figures, therefore, as noted earlier, each acre should be capable of providing seed for about $1\frac{1}{2}$ acres new planting each year. This by no means exhausts potentialities. Odd palms consistently returning over 800 grammes wet meat are met with. One in particular has so far averaged over 900 grammes and yields 70—80 nuts per annum or half a picul of copra from a relatively low nut output. The largest nut handled gave over 1100 grammes wet meat, which equals 100 nuts per picul.

Conclusions.

- (1). By seed selection it should be possible to increase copra output per acre to a figure considerably in excess of that now accepted as normal.
- (2). Examination of possible parent palms must cover both number of nuts and copra yield per nut. Also, having obtained seed of the required standard it is necessary to study nursery results in view of the fact that certain palms persistently yield nuts of low germination percentage and poor growth characteristics. Seed from high yielding palms is useless if it refuses to germinate, or having done so, produces progeny unfit to plant.
- (3). Close selection of seed calls for nothing which cannot be carried out in ordinary estate practice, and is a simple matter on estates which contain areas of high yielding palms.
- (4). With the standard scaled down to 100 nuts of 500 grammes palms, under 20 piculs per acre, only 6 per cent. of palms in a given area are fit for selection as mother palms.
- (5). In the light of (4) mass seed collection from the best known areas can only be termed crude and haphazard.

Acknowledgment.

The writer is indebted to Dr. H. W. Jack, M.B.E., Economic Botanist, S.S. and F.M.S. for his lecture delivered at the Bagan Datoh Club on 2nd May 1929, subject "Improvement of the Coconut Crop by Selection". (*Malayan Agricultural Journal*, Vol. XVIII, No. 1.) Although no references are made to this paper, it furnished the incentive which led to the initiation and execution of the work described in this article, and the present conclusions confirm many of the statements made in that publication.

Miscellaneous Article.

OIL PALM FACTORY ON ULU REMIS ESTATE, JOHORE.

A further stage in the development of the oil palm industry in Malaya was reached on March 27th 1933 with the opening of the new oil palm factory on Ulu Remis Estate, Layang Layang, Johore, by H.H. the Sultan of Johore, who was accompanied by H.H. the Sultanah.

Ulu Remis Estate is owned by Oil Palms of Malaya Ltd., for whom Messrs Guthrie & Co., Ltd. are the Agents. The Estate comprises approximately 10,000 acres of oil palms, of which approximately 4,000 acres are now in bearing.

The press system has been adopted for the treatment of the fruit, the machinery being supplied by Messrs Gebr. Stork & Co., Amsterdam, Holland, for whom Messrs Guthrie & Co., Ltd. are the local Agents.

While it is not proposed to give a detailed description of the plant, reference will be made to certain special features, since there is no doubt that as regards both lay-out of factory and design of plant the whole installation constitutes a marked improvement on other press installations, by the same firm, already working in Malaya.

In order, however, to facilitate reference, it is proposed to give a brief description of the present factory process.

Description of Process.

Transport and Sterilisation of Bunches. The fruit bunches are harvested and transported in trucks on the light railway to the factory, where the trucks are weighed and the amount of bunches recorded.

The loaded cages pass into the steriliser, where the bunches are subjected to a maximum steam pressure of 40 lbs. per square inch for a period of approximately 50 minutes.

Sterilisation of bunches under this steam pressure has the effect both of arresting enzyme action in the fruit, which is responsible for the development of acidity in the oil, and of loosening the individual fruits in the bunch.

Excess steam pressure in the steriliser is followed by vacuum treatment with the object of reducing the moisture content. As regards the press system a reduction in moisture content of the pericarp is an advantage, since it ensures a more satisfactory recovery of oil owing to the smaller amount of cellular matter expressed with the oil. Vacuum treatment has the additional advantage that, with the general reduction in moisture content of the fruit, the kernels tend to shrink in the shells, thereby facilitating subsequent nut cracking, while it is also claimed that this treatment improves the colour of the flesh of the kernels. Under pressure sterilisation, kernels are apt to become slightly discoloured owing to the penetration of dark-coloured fruit juices, and even palm oil, and it is claimed that the subsequent vacuum treatment assists in the removal of such contaminants.

Separation of Fruit. The cages containing the treated fruit bunches are raised by means of electric hoists to the top of the building, where the threshing machines are installed. The empty cages are lowered to ground level and replaced on bogies ready for despatch to the field.

The fruit bunches pass through the threshing machines, which separate the fruit from the bunch stalks. The fruit passes to an automatic weighing machine prior to being digested, and the bunch residue is collected in trucks. This residue may be dried and used as fuel for the boilers or taken back to the field for returning to the soil.

Treatment of Fruit. The fruit is then digested, the mash being delivered to the presses for recovery of oil. The digesters and the presses are of much greater capacity than Stork presses installed on other estates. Reference will be made later to the improvement in design.

Purification of Oil. The crude oil is taken to the purification plant, where it is first treated with live steam, and the mixture of oil and water allowed to settle. After sedimentation the washed oil is passed through a filter press before being pumped to the large storage tank, from where the oil is delivered to railway tank wagons for despatch to the bulk installation plant at Singapore.

If it is necessary to reduce the impurities still further the oil from the filter press can be subjected to a vacuum drying treatment, which, with a further filtration, would result in the preparation of an oil free from moisture and dirt.

The sludge from the washing tanks is treated for the recovery of a further quantity of oil before it is allowed to run to waste.

Separation of Nuts and Fibrous Residue. The press residue is broken in a crusher and treated in a special form of multiple drum drier, through which hot air circulates. The separation of the pericarp residue from the nuts is effected finally by means of a blast of air. Since there is no secondary recovery of oil, the fibrous residue is discharged direct to the boilers.

Treatment of Nuts. The clean nuts from the depericarper are graded according to size and passed to the nut cracking machines. The separation of the fragments of shell and the kernels is effected by means of a suspension of clay in water, in which the kernels float, while the fragments of shell sink. Automatic arrangements are available for washing both the kernels and fragments of shells with water in order to free them from adhering clay. The kernels are dried before bagging, while the fragments of shell are used as fuel for the boilers.

Remarks.

As regards the lay-out, the principal feature is the generous scale on which the factory has been designed, ample space having been provided for the installation of additional machinery at any particular stage of the process. Such foresight is most commendable, since it ensures that dislocation of work in a factory is reduced to a minimum when further machinery must be installed in order to deal with increased crops of fruit.

As mentioned previously, the capacity of the press has been increased considerably, those installed having a capacity of approximately 4 times as much as the press installed at the Government Experimental Plantation, Serdang. This increase will result in an increased rate of working without the necessity of additional labour.

The writer was much struck with the design of the new presses, especially with the absence of exudation of oil from the top of the press when working.

A further noticeable feature of the plant is the provision of weighing machines at various stages for recording the weights of different products, thereby facilitating the introduction of a system of factory control by which the optimum conditions of working may be determined and the maximum recovery of products obtained.

Compared with similar installations there is no doubt that the plant on Ulu Remis Estate constitutes a marked improvement in every way, and all those concerned are to be congratulated in providing the Estate with a factory which, as far as press installations are concerned, may be described as second to none.

C. D. V. G.

Abstract.

THIRTEENTH REPORT ON NATIVE RUBBER CULTIVATION.

Fourth Quarter 1932.

Prepared by the Bureau of Agricultural Economics of the Division of Agriculture of the Netherland Indian Department of Agriculture, Industry and Commerce, at Buitenzorg, Java, March 10th, 1933.

The report states that the rubber prices at Batavia were stabilised to a large degree during the fourth quarter of 1932 owing mainly to the fact that Japan was regularly in the market. Throughout the year, export of native rubber was influenced to a marked degree by the trend in prices, the lowest exports coinciding with the fall in prices during April, May and June. In 1932 the total exports in metric tons (dry equivalent) amounted to 62,381 as compared with 88,717 in 1931 and 90,496 in 1930.

While the drop in 1932 exports amounted to 30 per cent. of those in 1931, in consideration of the fact that the potential production is steadily increasing (250 thousand tons in 1932 as compared with 200 thousand tons in 1931) it will be seen that a very considerable voluntary and natural restriction took place, the actual production only amounting to 25 per cent. of the potential production in 1932.

In most of the producing districts, native rubber cultivation has declined in importance in favour of the cultivation of food crops, the former being regarded only as a means of raising money for necessary purposes when required, tapping activities being, in consequence, conducted in a very irregular manner.

There has also been a marked decline in the activity of plants which prepare rubber for export, the export of machine-worked rubber dropped to 43 per cent. of the quantity exported in 1931.

The following are among the interesting points abstracted from reports from the various producing areas:—

Acheen and Dependencies. An increase in production in the fourth quarter as compared with the third is to be explained by the favourable trend in prices and also by the fact that labour was not absorbed by rice cultivation. In spite of the important drop in prices during the middle of December tapping was continued and stocks increased. It was observed that family labour was used more than formerly, hired labour being only employed sporadically on some of the larger holdings.

Taparoei. Exports of native rubber, which were low in October, rose in November but dropped again in December. Tapping was almost entirely stopped and Javanese labour which had been employed during the period of enhanced prices was obliged to leave this area and go to other parts of Sumatra.

Sumatra West Coast. On account of the slight improvement in prices during the fourth quarter tapping was renewed, the majority of the rubber being prepared in the form of wet slabs. Work was done mainly by family labour but wherever outside assistance was needed such labourers received two-thirds of the rubber produced.

Djambi. Rubber was sold direct by the producers to the buyers who carried on a barter traffic with the natives. Only in areas where insufficient production of food crop occurs may it be said that rubber is still the leading industry. The number of hired labourers declined steadily.

A small amount of rubber was cut down for the planting of food crops.

Palembang. It is estimated that during the fourth quarter less than 10 per cent. of the tappable area in the province was being tapped, tapping only being carried out when the need for cash was greatest.

Western Division of Borneo. This region exported more rubber during the fourth than in previous quarters. This is accountable for by the fact that the period October—December is the lean time between harvests of food crops, and that money was required for the cleaning up of neglected holdings and for the approach of the native and Chinese holidays.

Southern and Eastern Division of Borneo. Work in connection with the cultivation of padi and other food crops and the decline in prices in December caused a considerable decrease in rubber production towards the end of the quarter.

Generally the tapping or non-tapping of holdings is connected with the necessity of obtaining money for payments which cannot be made in kind, although wherever small-holders own none but rubber land, tapping is of necessity carried out, since alternative work is not available.

AGRICULTURAL MARKETING BILL, 1933.*

A new Bill dealing with the marketing of agricultural products was introduced in the House of Commons on March 6. Major Elliot moved the Second Reading on March 13 and the debate on this stage of the Bill was concluded on March 20.

As its title suggests, the Bill is a development from the Agricultural Marketing Act, 1931. It is divided into four parts, the main provisions of which are briefly explained below.

Part I deals with the regulation of supply which, in some cases, is necessary to secure the effective reorganization of marketing and the stabilization of markets. Regulation of supply involves regulation of the two tributaries of the market-stream, namely, imports and supplies from home sources. Clause 1 accordingly empowers the Board of Trade to regulate the importation of a product if it appears that such action is necessary in order to enable the reorganization of a branch of the agricultural industry by a scheme under the Act of 1931 to be fully effective; and Clause 2 empowers the Ministers responsible for agriculture in the United Kingdom to regulate the home output of any product which is the subject of an important Order under Clause 1.

These Clauses enable effect to be given to recommendations of the Reorganization Commission for Pigs and Pig Products†. The possibility of proceeding by voluntary agreement rather than by compulsory Order is not precluded. Provision is also made in this part of the Bill for the appointment of a Market Supply Committee whose chief function will be to make a continual and expert study of supply problems, which the policy of supply regulation must solve, and to advise the Ministers in the exercise of their function in that connexion.

Part II also gives effect to the recommendations of the Reorganization Commission for Pigs and Pig Products. It provides for the joint exercise of power by producers of a secondary product (*e.g.*, bacon) and of a primary agricultural product (*e.g.*, pigs), being the raw material of the former product, and for the organization by these producers of the production of the secondary product. The method by which producers can acquire these powers follows the democratic precedent set by the 1931 Act, that is to say, they are enabled to submit a scheme constituting a development board equipped with such powers, within the scope of Clause 6 of the Bill, as the scheme may provide.

Part III, and the Third Schedule contain a number of amendments to the 1931 Act, the desirability of which had been suggested by the experience of the Reorganization Commissions for Milk and for Pig Products and of the Hops Marketing Board; and Part IV contains a number of miscellaneous and supplementary provisions, one of which, limiting validity of contract in the sale of eggs to transactions conducted on the basis of weight or statutory grade, is designed to meet, in some degree, the generally-expressed desire for further legislation to encourage the standardization of egg-grading.

* Abstracted from the Journal of the Ministry of Agriculture, Vol. XL, No. 1, April 1933.

† Report of the Reorganisation Commission for Pigs and Pig Products: Economic Series No. 37.

MALAYA AT THE BRITISH INDUSTRIES FAIR 1933.*

The British Industries Fair (February 20th to March 3rd 1933) was again held simultaneously at Olympia (general exhibits), the White City (textiles and furniture) and Birmingham (machinery). The Empire Marketing Board Section was, as in previous years, situated at Olympia, and the Malaya stand occupied the same corner site as in 1932.

A new style of stand-construction was adopted this year by the Empire Marketing Board, the main feature of which was that the display-counters were fronted with chromium plate. Aided by this very effective novelty, it was an easy matter to make the Malayan stand attractive by the usual array of coloured cut-outs, maps, posters and weapons, while the stuffed tiger, backed by a gong, hung from a pair of elephant tusks, formed an arresting centre-piece.

The front counters were devoted to the display of the chief exhibits *viz.*, tinned pineapple, rubber firelighters, the industrial applications of "Revertex", and palm oil.

There was a very pleasing volume of inquiry for Malayan pineapple from continental buyers, particularly from those representing Scandinavian firms.

Four varieties of rubber firelighters were exhibited. *viz.*, (a) ordinary plantation crepe made up in bundles, (b) and (c) two sorts of lighter composed of rubber, coconut fibre and wax, and (d) the "Rubylite", composed of rubber, sawdust and paraffin.

Demonstrations with all these types of firelighter were given. The qualities of "Rubylite", which seemed to make the most telling appeal, were cleanliness, economy and absence of odour. The substance is made up in small cakes retailed at 6d. per 1 lb. packet, the quantity in such a packet being sufficient, it is claimed, to kindle between 30 and 40 fires, which works out cheaper than firewood.

Enquiries for these firelighters were received from Canada, Belgium, Ireland, Norway and Germany.

The "Revertex" exhibits were varied in nature and included, amongst others, the following:—"Plasoleum" process as applied to roadways, tennis-courts and cricket-pitches; glass tiles fixed to bathroom walls with coloured "Revertex"; rubber flooring; rubber boot-lace tags; machine beltings; splash-proof materials for covering walls; cushion-stuffings of "Revertex" combined with pigs' hair; sponges; carpet-fabrics; shoe-insoles; tank-linings; beach shoes and Wellingtons; hessians for baling perishable goods; toys; perambulator-coverings; soles and heels; surgical gloves; non-slip bath mats.

It need scarcely be said that the "Plasoleum" roadway was the most important among these varied exhibits and it attracted a degree of attention beyond the most optimistic expectations. For this favourable notice, the two chief reasons were (a) that roads treated with "Plasoleum" are claimed to have been definitely proved to be skid-proof and (b) that the price is reasonable. It is

* Abstract of Report by Mr. H. S. Banner, Publicity Officer, Malayan Information Agency.

at present approximately £1 per square yard laid, and is likely to become cheaper still in the near future.

The exhibit was directly instrumental in introducing the process to a large number of City and Borough engineers. Many interesting suggestions for applications of the process were received at the stand, some of which might well lead to new developments on a large scale. One such proposal which deserves a mention was for "Plasoleum" floors in cow-houses, to preserve the cows from the chills which are so often imparted by bare concrete.

It should be added that the decision to make a specially prominent feature of "Revertex" exhibits was due to the fact that this process appears to be one of the more promising roads to the adoption of "new uses" for rubber on a really big scale.

With regard to palm oil an opinion was expressed that palm oil produced in Africa is likely to remain a low grade product, fit only for the soap making industry, leaving the edible fat manufacturing market open for higher grade oils, and that painstaking research should enable Malaya to produce an oil, from the oil palm, capable of competing very favourably with the best coconut oil for the edible fat market.

The stand was visited by Her Majesty the Queen, the Princess Royal, the Duke and Duchess of York, Prince George, the Prime Minister, Sir Philip Cunliffe-Lister, the Lord Mayor, and many other distinguished personages, all of whom expressed a keen interest in the display.

From the point of view of genuine business enquiry, it is felt that this year's British Industries Fair was beyond question the most successful in which Malaya has participated, and it is particularly gratifying to feel that some material benefit may accrue, as the result, to the rubber industry.

Departmental.

FROM THE DISTRICTS.

The Weather.

The fairly heavy rainfall of April continued for the first half of May in Kedah, Province Wellesley and North Perak but the remainder of the month was considerably drier. As compared with the average for the month total precipitation approximated to normal for Kedah and was normal or below average for Province Wellesley and North Krian. From there southwards, however, the rainfall was well above average throughout South Perak, Selangor, Negri Sembilan and West Pahang and heavy rain persisted throughout the month in the three last named areas, so that in many parts the total greatly exceeded the average for May.

In parts of Johore also the rainfall was well above average but approximated to normal in Malacca, Singapore and East Pahang whilst the very dry weather of Kelantan continued.

Remarks on Crops.

Rubber. The highest and lowest prices in dollars and cents per pikul, recorded during the month in returns from a large number of centres throughout the country, were—Smoked Sheet \$8 to \$12.25; Unsmoked Sheet \$7 to \$11.25; Scrap \$1.80 to \$5.50. The average Singapore price recorded for small-holders' rubber is—Smoked Sheet \$11.80; Unsmoked Sheet \$11 and Scrap \$5 whilst Penang prices for Unsmoked Sheet ranged from \$7 to \$10.30.

It is reported from most parts of the country that this substantial increase in price has resulted in many more holdings being brought into tapping. In many areas, however, the frequency of wet mornings has reduced the opportunities for tapping so that in such areas no marked increase in production is likely to have yet taken place. Reports indicate that there has been a general tendency throughout the country for small-holders to clear up heavy undergrowth from holdings, suggesting an enlivened interest in the crop.

The position regarding Mouldy Rot disease remains similar to that reported last month, namely, although wet weather has induced increased activity of the disease on tapped holdings, sufficient attention to control is generally given to prevent heavy damage to bark.

Padi. The price of padi at the Government Rice Mill at Bagan Serai has been maintained at the figure of \$1.60 a pikul given last month. In Kedah the price has risen slightly being from \$9—\$9.50 a kuncha (160 gantangs) as compared with last month's figures of \$8—\$8.50. The present price is approximately equivalent to from 5½ to 6 cents a gantang as compared with 6½ cents as equivalent for the Bagan Serai quotation.

Last season's crop in Kedah is now estimated to have totalled 75½ million gantangs, higher than any crop yet recorded.

In Malacca there has been a heavy demand from cultivators for the purchase of specially high yielding pure strain seed for next season's sowing. Some 4,000 gantangs have been sold and all available seed of the best three strains has been disposed of.

Coconuts and Copra. Further satisfactory reports are to hand regarding the improvement of Copra production in Province Wellesley. Consignments from two of the recently erected approved pattern kilns received the prices ruling on the Penang market for best quality copra, and consignments are now being sent regularly to Penang from several of such kilns.

Some further progress is reported in the erection of the approved types of kilns in Bagan Datoh but the low price that has prevailed for copra has tended to retard matters in some instances.

In Selangor, a slight improvement is reported in relation to the kiln in the Klang district.

In Johore, arrangements have been completed for the sale of well prepared small-holders' copra to a firm in Singapore.

Coffee. For some time past attention has been given to encouraging Malay small-holders, in the Kuala Langat district of Selangor, to prepare their own coffee and assistance has been given them to find suitable markets. It is reported that much of the coffee so prepared commands a premium over the coffee prepared by Chinese in the district.

Agricultural Stations.

During the month the Director and the Chief Field Officer visited several of the Agricultural Stations and the following notes are made in the light of these visits and are not only based on the monthly reports.

Now that the planting programme on Bukit Mertajam Station, Province Wellesley, is well advanced, the advantage of the care given to the lay-out of the station is emphasised. A pleasing feature is the well kept grass paths that give easy access to all the plots and which were planted with carpet grass as part of the preliminary establishment work. The present appearance of all the crops planted is very satisfactory. On the area as yet unplanted a very satisfactory stand of cover crops has been established with the help of a light dressing of basic slag at the time of sowing, and the good appearance of the crop is maintained by selective hand weeding.

The Sungei Udang Station, in Malacca, is the most advanced of any of the Stations and is now in a fair way towards providing an example of what was envisaged when plans for the establishment of these Stations were formulated. This Station includes a small area of padi land which is at present being cultivated preparatory to planting next season's crop.

Cheras Station, in Selangor, includes poultry demonstrations, market gardening for the purpose of studying Chinese methods and pig rearing. The Station was well laid out, and is at present maintained in a fairly satisfactory manner, though in wet weather some difficulty is experienced in keeping the Station free of weeds on the sum allotted for its upkeep for the year.

Further progress has been made during the month on the lay-out of the Rembau Station in Negri Sembilan.

The Pineapple Station in Singapore is now providing preliminary results from many of the experiments on manuring and cultivation that were laid down. Apart from the main crop, some good results are being obtained from propagating desirable varieties of Rambutan by the etiolation method which has been employed successfully in England in raising fruit stocks true to type.

Padi Stations & Test Plots.

The coming season's programme for Titi Serong has been laid down, and, on most Stations and Test Plots, areas have been demarcated for next season's experiments and demonstrations.

DEPARTMENTAL NOTES.

Visits and Tours.

The Director of Agriculture, Dr. H. A. Tempany, C.B.E., visited Cameron Highlands from May 18th to May 20th and inspected the Experiment Station at Tanah Rata.

The Director also visited Krian and Kuala Kangsar and Province Wellesley from the 25th—27th May and inspected the Experiment Stations and other agricultural undertakings at these places.

The acting Chief Field Officer, Mr. F. Birkinshaw, who accompanied the Director on the tours mentioned above, visited Singapore on May 30th.

Mr. J. H. Dennett, Assistant Chemist, visited a number of the Stations and padi areas in Perak during the month of April in connection with padi soil investigations.

Mr. J. N. Milsum, Senior Assistant Agriculturist, visited Sumatra from May 4th—May 19th with the object of studying conditions and progress in relation to the oil palm industry in that country.

School of Agriculture, Malaya.

The School year closed on 13th April and the first term of the present School year commenced on May 15th. It has been decided to introduce practical instruction on poultry husbandry, into the curriculum, during the coming School year. Operations will be on a modest scale only, until experience has been gained. A site has been prepared, and the necessary pens and sheds are in course of erection.

The F.M.S. Government has decided to award six major and six minor Scholarships for the School this year. Regulations have been sent to all Schools concerned, and numerous applications have been received, particularly for the minor Scholarship.

A party of pupils from the High School, Kajang, visited the School during April.

The Rural Lecture Caravan.

An extensive tour of the Ulu Langat, Kuala Langat, Klang, Kuala Selangor and Sabak Bernam Districts was made by the Caravan during the latter part of February and the first week of March 1933. The subjects for the afternoon lectures depended on the locality, and referred principally to food crops, coffee cultivation and preparation, copra and padi.

The Caravan made a three week's tour in Malacca from March 17th to April 5th and visited seventeen centres. At most centres the people who attended the afternoon lectures showed keen interest and numerous questions were asked.

Staff changes and leave

Mr. H. T. Pagden, formerly Assistant Entomologist, Department of Agriculture, S.S. and F.M.S., has been seconded for service in the British Solomon Islands to investigate certain problems connected with the coconut industry in these Islands.

On his way to take up his new appointment, Mr. Pagden disembarked at Penang and spent some days in Perak and Kuala Lumpur prior to sailing from Singapore on May 20th.

Mr. H. J. Simpson, Agricultural Field Officer, Selangor, has been granted 21 days convalescent leave and 22 days casual leave. Mr. Simpson departed on a sea trip, to Japan and back, on April 29th.

Statistical.

MARKET PRICES

May 1933.

Rubber.—The market price for rubber has risen steadily during the month, opening at 8 3/16 cents per lb. for spot loose in Singapore and closing at 10½ cents. The latter is the highest prices reached since December 30th., 1931. The average price for the month was 9.08 cents per lb. in Singapore, 2.87 pence in London and 4.8 cents, gold, in New York, as compared with 6.92 cents, 2.34d. and 3.47 cents gold respectively in April.

Palm Oil.—The course of the English market during May, on a basis of 18 per cent. f.f.a., c.i.f. Liverpool, was as follows:—4th. £16 per ton; 11th. £16.10.0; 18th. £18; 25th. £19.

Prices in the U.S.A., landed weight per pound in bulk c.i.f. New York/Philadelphia, were 2.85 cents, gold, on 3rd., 3.00 cents on 10th. and 17th., and 3.05 cents on 24th.

The price of palm kernels Fair Average Malayan Quality c.i.f. landed weight on the Continent rose from 18s. 9d. per cwt. on 3rd. to 21s. 6d. on 24th.

Copra.—The market improved towards the end of the month. The highest Singapore price for sundried during May was \$4.35 per picul (29th.—31st.), the average price being \$3.96 per picul as compared with \$3.82 during April. The mixed quality averaged \$3.70 per picul as compared with \$3.56 in April.

Coffee.—Prices at Singapore for Sourabaya coffee declined during the month, ranging, according to grade, from \$20 to \$22.50 as compared with \$22.50 to \$26 during April.

Palembang coffee dropped from \$18.50 to \$16.50 averaging \$16.87 as compared with \$18.87 in April.

Arecanuts.—Palembangs averaged \$2.61 and Bila Whole averaged \$2.86 per picul, as compared with \$2.32 and \$2.33 respectively during April. The range of Singapore prices for other grades were:—Split 3.50 to \$5; Red Whole \$3.50 to \$5; Sliced \$5 to \$8.50; Kelantan \$3.25 to \$4.80.

Rice.—The following are the average wholesale prices per picul of rice in Singapore during April:—Siam No. 2 \$3.69, Rangoon No. 1 \$3.40, as compared with \$3.40 and \$3.05 per picul during March. The average retail market prices in cents per gantang of No. 2 Siam rice in April were:—Singapore 26, Penang 28, Malacca 27, as compared with 26, 28 and 27 cents respectively in March.

Gambier.—Block Gambier declined slightly, the average price being \$3.94 per picul, Cube averaged \$7.50 per picul. Corresponding prices for April were \$4.44 and \$8 per picul respectively.

Pineapples.—Though the turnover has not been large, values are firmer and Packers are inclined to hold in anticipation of better prices: the average

Singapore prices per case in May were :—Cubes \$2.85, Sliced Flat \$2.75, Sliced Tall \$2.99, as compared with \$2.99, \$2.89 and \$3.11 respectively during April.

Tapioca.—The price of Flake averaged \$4.36 as compared with \$4.17 in April. Pearl Seed averaged \$5.06 as compared with \$4.93 in April and Pearl medium averaged \$5.31 as compared with \$5.12 in the previous month.

Sago.—Pearl small fair remained steady at \$4.40 as compared with \$4.42. Flour Sarawak Fair averaged \$1.85 as compared with \$1.79 in April.

Mace.—Average prices, more or less nominal, were \$60.50 per picul for Siouw and \$38 for Amboina.

Nutmegs.—There has been small demand during the month. The average Singapore price per picul for 110's was \$18.12 as compared with \$19.50 in April. 80's remaining steady at \$24.25 as in the previous month.

Pepper.—Average Singapore prices during May were as follows :—Singapore Black \$15.25 per picul, Singapore White \$24.87 and Muntok White \$25.62, the corresponding prices for April being \$13.63, \$20.94 and 21.50 respectively.

Cloves.—There has been no demand for cloves, nominal prices being quoted at \$40 for Zanzibar and \$45 per picul for Amboina.

The above prices are based on London and Singapore daily quotations for rubber; the Singapore Chamber of Commerce Weekly Reports for the month and on other local sources of information. Palm oil quotations are kindly supplied by Messrs. Cumberbatch & Co., Ltd. and Messrs. Guthrie & Co., Ltd., Kuala Lumpur, and the Singapore prices for coffee and arecanuts by the Lianqui Trading Company of Singapore.

1 picul = 133½ lbs. The Dollar is fixed at 2s. 4d.

Note.—The Department of Agriculture will be pleased to assist planters in finding a market for agricultural products. Similar assistance is also offered by the Malayan Information Agency, 57, Charing Cross, London, S.W. 1.

GENERAL RICE SUMMARY.

April, 1933.

Malaya.—Gross foreign imports of rice (including stocks available for re-export) during April 1933, amounted to 43,579 tons, (as compared with 38,275 tons in April 1932) of which 50 per cent. were consigned to Singapore, 21 per cent. to Penang, 6 per cent. to Malacca, 20 per cent. to the Federated Malay States and 3 per cent. to the Unfederated Malay States.

Of these imports, 50 per cent. were from Siam, 46 per cent. from Burma, 3 per cent. from Indo-China and 1 per cent. from other countries.

Total foreign exports of rice from Malaya in April 1933, were 11,344 tons (including 263 tons local production) as compared with 12,821 tons in April 1932.

Of these exports 80 per cent. were consigned to Netherlands India and 20 per cent. to other countries.

Net imports for the period January to April 1933, were 130,683 tons as compared with 139,539 tons during the same period for 1932, a fall of 6 per cent.

India and Burma.—Total foreign exports of rice during March 1933, were 277,000 tons as compared with 174,000 tons in the previous month and 357,000 tons in March 1932.

Total exports of rice and bran from Burma during the period January 1st to April 1st 1933, amounted to 890,692 tons as compared with 1,087,596 tons for the corresponding in 1932, a decrease of 18.1 per cent.

Siam.—Exports (approximate) during April 1933, amounted to 135,112 tons as compared with 113,555 tons in April 1932.

Netherlands India, Java and Madura.—At the end of March 1933, the area harvested amounted to 1,179,000 acres a decrease of 112,000 acres or 9 per cent. as compared with the corresponding period of 1932: the area damaged was 30,000 acres a decrease of 7,000 acres or 19 per cent. as compared with 1932, and additional plantings awaiting harvesting amounted to 6,993,000 acres an increase of 217,000 acres or 3 per cent.

French Indo-China.—Entries of padi at the port of Cholon from January to April 1933 amounted to 441,000 (metric) tons, an increase of 137,000 tons or 45 per cent. as compared with the same period of 1932.

Exports of rice from Saigon for the period January to April 1933 totalled 502,000 tons, an increase of 92,000 tons or 22 per cent. as compared with the corresponding period of 1932.

Ceylon.—Imports for the period January to March 1933 totalled 112,920 tons, a decrease of 18,989 tons on the imports for the same period of 1932.

Of these imports 19 per cent. were from British India, 74 per cent. from Burma, and 7 per cent. from other countries.

Europe and America.—Quantities of rice shipped from the East were :—

- (a) To Europe for the period January 1st to April 20th, 458,268 tons, a rise of 136,269 tons or 42 per cent. as compared with the same period of 1932. Of these shipments 44 per cent. were from Burma, 5 per cent. from Japan, 42 per cent. from Saigon, 8 per cent. from Siam and 1 per cent. from Bengal, as compared with 62 per cent. from Burma, nil from Japan, 31 per cent. from Saigon, 2 per cent. from Siam and 5 per cent. from Bengal in 1932.
 - (b) To the Levant, period January 1st to March 22nd, 9,457 tons, a fall of 13,104 tons or 58 per cent. as compared with the same period of 1932.
 - (c) To American and the West Indies for the period January 1st to March 31st 1933, 27,684 tons, a decrease of 16,226 tons or 37 per cent. as compared with the same period of 1932.
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MALAYA RUBBER STATISTICS

ACREAGES OF TAPPABLE RUBBER NOT TAPPED ON ESTATES OF 100 ACRES AND OVER, FOR THE MONTH ENDING APRIL, 1933.

STATE OR TERRITORY	Acreage of Tappable Rubber end 1932	ESTATES WHICH HAVE ENTIRELY CEASED TAPPING		ESTATES WHICH HAVE PARTLY CEASED TAPPING		Total (3) + (5)	Percentage of (7) to (2)
		Acreage (3)	Percentage of (3) to (2) (4)	Acreage (5)	Percentage of (5) to (2) (6)		
STRAITS SETTLEMENTS :—							
Province Wellesley	44,734	2,350	5.3	8,368	18.7	10,727	24.0
Dindings	6,969	404	5.8	920	13.2	1,324	19.0
Malacca	111,780	5,840	5.2	21,954	19.6	27,794	24.9
Penang Island	1,635	1,259	77.0	55	3.4	1,314	80.4
Singapore Island	28,269	14,038	49.7	3,659	12.9	17,697	62.6
Total S.S.	193,387	23,900	12.3	34,956	18.1	58,856	30.4
FEDERATED MALAY STATES :—							
Perak	250,951	15,475	6.2	32,745	13.0	48,220	19.2
Selangor	308,379	21,050	6.8	41,110	13.3	62,160	20.1
Negri Sembilan	228,541	17,928	7.8	20,250	8.9	38,178	16.7
Pahang	38,141	9,028	23.7	4,790	12.5	13,818	36.2
Total F.M.S.	826,012	63,481	7.7	98,895	12.0	162,376	19.7
UNFEDERATED MALAY STATES :—							
Johore	325,747	45,081	13.8	31,340	9.6	76,421	23.5
Kedah (a)	114,551	8,909	7.8	6,985	6.1	15,894	13.9
Kelantan	21,175	9,774	46.2	1,377	6.5	11,151	52.7
Trengganu (b)	4,352	Nil	Nil	2,072	47.6	2,072	47.6
Perlis (a)	957	106	11.1	502	52.5	608	63.5
Total U.M.S.	466,782	63,870	13.7	42,276	9.0	106,146	22.7
Total MALAYA	1,486,181	151,251	10.2	176,127	11.8	327,378	22.0

Notes :— (a) Registered companies only and are rendered quarterly.

(b) Registered companies only.

The above table together with a Summary, was prepared and published by the Statistics Department, S.S. and F.M.S. in May 1933.

MALAYAN AGRICULTURAL EXPORTS. APRIL, 1933.

PRODUCT.	Net Export in Tons.				
	Year 1932	Jan.-April 1932	Jan.-April 1933	April 1932	April 1933
Arecanuts ...	20,280	9,098	7,949	1,990	2,443
Coconuts, fresh ...	108,123†	33,168†	30,652†	10,191†	9,043†
Coconut oil ...	11,932	3,499	6,312	857	1,676
Copra ...	97,464	24,026	29,160	5,383	8,258
Gambier, all kinds ...	2,925	1,016	749	187	156
Palm kernels ...	1,248	300	418	35	65
Palm oil ...	7,892	1,929	2,301	485	1,199
Pineapples, canned ...	66,291	22,543	17,635	6,169	4,700
Rubber ...	417,137	137,237	136,056	32,161	36,752
Sago,—flour ...	10,267	4,453	1,529	691	48
" —pearl ...	3,128	853	665	211	160
" —raw ...	4,148*	1,273*	1,373*	224*	295*
Tapioca,—flake ...	9,028	3,092	4,135	914	1,080
" —flour ...	392	108*	64	13*	28
" —pearl ...	19,977	6,585	5,600	1,913	2,135
Tuba root ...	165½	41½	126	11½	46

† hundred in number.

* net imports.

ACREAGES OF TAPPABLE RUBBER OUT OF TAPPING IN
NETHERLANDS INDIA AT END JANUARY, 1933.

	A Totally Ceased.		B Partly Ceased.		Total A & B	
	Estates	Area in acres	Estates	Area in acres	Estates	Area in acres
Java and Madura ...	135	56,000	67	18,135	202	74,135
Outer Provinces ...	204	74,537	69	41,360	273	115,897
Netherlands India ...	339	130,537	136	59,495	475	190,032

The total area out of tapping for January amounts to 19 per cent. of the total tappable area at end of December, 1932.

(Authority: Economisch Weekblad dated 17th March, 1933).

TABLE I
MALAYA RUBBER STATISTICS
STOCKS, PRODUCTION, IMPORTS AND EXPORTS OF RUBBER, INCLUDING LATEX, CONCENTRATED LATEX AND REVERTEX,
FOR THE MONTH OF APRIL, 1933 IN DRY TONS.

Territory	Stocks at beginning of month 1				Production by Estates of less than 100 acres and over				Imports				Exports including re-exports during the month				Stocks at end of month		
	Dealers		Estates		during the month		to the month		during the month		from the month		during the month		from the month		Ports	Dealers	Estates and acres over
	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17			
MALAY STATES:—																			
Federated Malay States	...	11,855	10,969	9,652	42,032	7,271	29,124	Nil	Nil	Nil	Nil	11,861	5,437	53,040	23,585	...	12,036	10,394	...
Johore	...	2,544	3,238	3,411	13,496	4,759	16,041	Nil	4	Nil	11	1,047	6,378	3,956	25,663	...	2,688	3,243	...
Kedah	...	444	1,891	2,030	8,435	1,126	4,401	Nil	Nil	Nil	Nil	955	2,042	4,531	9,257	...	455	1,969	...
Perlis	...	94	19	21	51	21	29	Nil	Nil	Nil	Nil	Nil	8	Nil	68	...	25	12	...
Kelantan	...	145	14	145	548	52	1,365	Nil	Nil	Nil	Nil	100	507	290	1,652	...	199	155	...
Trengganu	...	55	50	123	383	62	192	Nil	Nil	Nil	Nil	186	Nil	Nil	577	...	55	50	...
Total Malay States	...	15,067	16,234	15,368	65,039	13,147	51,153	Nil	4	Nil	11	13,963	14,557	61,817	60,702	...	15,458	15,823	...
STRAITS SETTLEMENTS:—																			
Malacca	...	5,910	1,381	1,202	4,974	...	...	Nil	Nil	9	...	4,682	...	17,502	...	...	4,349	1,396	...
Province Wellesley	...	838	447	419	1,824	...	7,488	Nil	14,581	Nil	60,815	4,575	Nil	25,515	...	...	893	474	...
Dindings	...	30	107	82	366	1,740	...	328	...	1,805	...	...	...	...	...	...	517	35	...
Penang	...	842	4,624	8	2	...	...	5,703	...	21,415	...	...	...	...	...	...	2,797	4,419	...
Singapore	...	2,392	19,563	141	129	552	...	...	14,581	23,226	60,815	32,786	...	8,142	...	...	2,797	20,510	...
Total Straits Settlements	...	3,234	30,855	2,084	1,834	7,722	1,749	7,488	6,031	14,581	23,226	60,815	32,786	...	...	...	3,314	30,206	...
TOTAL MALAYA	...	3,234	45,922	18,318	17,202	72,761	14,896	58,641	6,013	14,585	23,229	60,826	36,752	14,557	162,974	60,702	3,314	45,604	17,933

TABLE II
DEALERS' STOCKS, IN DRY TONS. 3

Class of Rubber	Federated Malay States		S'pore	Penang		Ince. Wellesley	Johore	Total
	21	22	23	24	25	26	27	28
DRY RUBBER	9,960	18,585	8,946	5,139	1,008	127	...	...
WET RUBBER	3,076	1,925	473	138	1,680	328	...	...
TOTAL	12,036	20,510	4,419	5,277	2,688	455	...	...

TABLE III
FOREIGN EXPORTS

PORTS	For month	
	January 1933	April 1933
Singapore	20,765	92,664
Penang	7,911	39,929
Port Swettenham	5,758	24,643
Malacca	2,323	5,738
MALAYA	36,752	162,974

TABLE IV
DOMESTIC EXPORTS. 4

AREA		For month
		January 1933
Malay States		30,630
Straits Settlements		138,964
MALAYA		30,630

Notes—1. Stocks on estates of less than 100 acres and stocks in transit on rail, road or local steamer are not ascertained.

2. The production of estates of less than 100 acres is estimated from the formula: Production + Imports + Stocks at beginning of month = Exports + Stocks at end of month. i.e., Columns [7] = Columns [13] + [14] + [17] + [18] + [19] + [20]—[2]—[3]—[4]—[5]—[6]—[10]. For the Straits Settlements, Columns [7] and [8] represent purchases by dealers from local estates of less than 100 acres.

3. Dealers' stocks in the Federated Malay States are reduced to dry weights by the following fixed ratios: unsmoked sheet, 15%; wet sheet, 25%; scrap, lump, etc., 40%; stocks elsewhere are in dry weights as reported by the dealers themselves.

4. Domestic exports are estimated by deducting the average monthly dry weight of foreign imports over a period of 2 months from the gross foreign exports of the latter month, the foreign exports of the Malay States being domestic production.

5. The above, with certain omissions, is the report published by the Registrar-General of Statistics, S.S., and F.M.S., at Singapore on 23rd of May 1933.

METEOROLOGICAL SUMMARY, MALAYA, APRIL, 1933.

LOCALITY	AIR TEMPERATURE IN DEGREES FAHRENHEIT					EARTH TEMPERATURE		RAINFALL							BRIGHT SUNSHINE				
	Means of					PERATURE		Total	Most in a day	Number of days				Total	Daily Mean	Per cent			
	A.	B.	Min.	Max.	Mean of A and B	At 1 foot	At 4 feet			Precipitation, .01 in or more	Thunder-storms	Fog morning obs.	Gale force 8 or more						
	°F	°F	°F	°F	°F	°F	°F	°F	in.	mm.	in.				hr.	hr.	%		
Railway Hill, Kuala Lumpur, Selangor	90.1	72.6	81.3	94	70	81	75	84.5	85.1	11.38	289.1	2.03	20	19	8	7	161.00	5.37	44
Bukit Jeram, Selangor	87.2	73.0	80.1	90	70	81	75	84.1	86.2	6.63	168.4	2.17	16	14	4		175.70	5.86	48
Sitiawan, Perak	89.7	73.4	81.5	93	71	83	76	84.8	85.5	4.08	103.6	0.82	15	13	4		195.00	6.50	50
Kroh, Perak	87.8	70.9	79.3	94	66	79	73	82.4	83.0	10.39	263.9	2.16	22	19	6	4	192.00	6.40	52
Temerloh, Pahang	90.0	73.3	81.6	94	69	85	76	85.2	85.6	6.75	171.5	2.26	11	11	1	2	205.25	6.84	56
Kuala Lipis, Pahang	89.5	72.3	80.9	96	69	84	74	84.1	84.5	10.73	272.5	2.31	18	13		17	188.40	6.28	51
Kuala Pahang, Pahang	87.2	74.6	80.9	90	71	83	77	85.3	85.2	8.11	206.0	1.98	14	13	2		243.65	8.12	67
Mount Faber, Singapore	87.9	74.3	81.1	92	70	82	77	82.2	82.4	4.33	110.0	0.93	17	13	6		169.00	5.63	46
Butterworth, Province Wellesley	87.8	74.8	81.3	91	72	80	77	85.3	85.6	9.23	234.4	3.26	15	14	1		219.60	7.32	60
Bukit China, Malacca	85.3	74.0	79.7	89	71	81	76	82.7	83.9	8.85	224.8	2.69	20	18	8		190.45	6.35	52
Kluang, Johore	87.8	71.5	79.7	92	69	80	73	81.7	82.0	9.45	240.0	2.80	22	17	8	15	157.05	5.23	43
Bukit Lalang, Mersing, Johore	86.8	72.5	79.7	91	70	83	78	82.2	81.7	4.16	105.7	0.80	15	12	1		188.15	6.27	51
Alor Star, Kedah	90.2	74.2	82.2	93	71	85	77	86.4	85.8	8.41	213.6	2.12	16	11	13	2	235.90	7.86	64
Kota Bharu, Kelantan	88.3	73.6	80.9	93	69	78	76	83.5	83.4	3.82	97.0	1.31	10	9			250.55	8.35	68
Kuala Trengganu, Trengganu	87.2	72.9	80.1	91	69	77	74	83.4	83.9	5.26	133.6	2.68	7	6	5		262.80	8.76	72
HILL STATIONS.																			
Fraser's Hill, Pahang 4268 ft.	73.8	62.9	68.3	78	59	67	65	71.7	71.9	13.37	339.6	1.99	24	21	4	7	121.70	4.06	33
Pahang Highlands, Tanah Rata, Pahang 4750 ft.	73.4	57.1	65.3	77	53	62	62	69.6	69.2	13.49	342.7	2.56	26	21	7	2	135.90	4.53	37
Cameron Highlands, Rhododendron Hill, Pahang 5120 ft.	72.4	60.0	66.2	76	58	66	62			13.91	353.3	2.86	26	21	2		144.15	4.81	39

Compiled from Returns supplied by the Meteorological Branch, Malaya.

ERRATUM.

Malayan Agricultural Journal, Vol. XX1, No. 5,
May 1933, p. 214, para. 4, line 4, for "1,300 lbs. of
oil per acre" substitute "1,500 lbs. of oil per acre"

THE Malayan Agricultural Journal.

JULY, 1933.

EDITORIAL.

Rubber in Malaya 1932.

The present issue of the *Malayan Agricultural Journal* contains an article by Dr. H. A. Tempany, C.B.E., reviewing the condition of the rubber industry in Malaya in the year 1932 and recording progress achieved in certain important lines of research, while it also includes statistical data with regard to production, consumption, stocks, prices and areas under cultivation.

The account is, of necessity, in some respects, a rather sad picture of the condition of the foremost Malayan industry which is passing through a period of depression never before equalled in its history. The industry during the year has had to face the fact that if production was to be maintained, drastic curtailment in the cost of production was vital, and it is encouraging to record that it has been found possible to reduce this cost to a figure which a few years ago would have been thought impossible.

On the other hand it must not be forgotten that the low cost of production has only been achieved by the adoption of a policy of curtailment of expenditure on items and on personnel which may eventually create a set of conditions which must be regarded as unstable, and, furthermore, despite the exercise of the most rigid economy comparatively few estates have been able to carry on without actual financial loss.

It is becoming more and more evident that the future of the industry will be dependent to a large extent on the aid of scientific research.

The present policy of the industry aims at attempting to increase the productive capacity of estates economically, by concentrating on maintenance and improvement of the more productive areas, and establishing bud-grafted areas with proved material, coupled with improved methods of cultivation and manufacture and extension of the uses of rubber and latex in industries additional to those in which it is at present employed.

Although the continued low price obtained for rubber has resulted in an increase of interest in other agricultural products, much still remains to be done in connection with the extension of alternative crops particularly amongst **Malay small holders**. There is no general tendency to replace rubber by another crop, but it is encouraging to record that, in areas where suitable land for the

cultivation of food stuffs for personal use is not available, small-holders are tending to cut out unproductive rubber, in order to plant foodstuffs. The Department of Agriculture is rendering assistance by advice, demonstration and the supply of material in cases where the land owner has experienced difficulties in this matter.

There is no doubt that the depressed economic condition of every agricultural product has retarded the immediate extension of "money" crops other than rubber, on a large scale in Malaya, and the possibility cannot be ignored that in the event of a return of full prosperity to the rubber industry, interest in alternative crops may once more tend to wane. This has happened in the past and may well happen in the future; it is essential that when return to prosperity occurs, the lessons of the present slump should not be forgotten. The policy of the Malayan Governments directed towards the encouragement of interest in the cultivation of rice and other food crops particularly amongst the Malay small-holders will, it is hoped, make a lasting impression on the mind of the raiat and so tend to counteract the danger to some extent.

Vegetative Propagation of Tea.

The propagation of plants by vegetative methods is of course a well established practice, and methods commonly adopted in the past are well understood. These methods aim at, either the production of roots from a portion of the parent plant by such methods as layering, bagging or marcotting, or planting of cuttings of stems, roots, or leaves, or the production of a composite plant by means of grafting, budding and approach grafting, in which the tissues of separate plants can be induced to unite.

In many instances it is considered to be advantageous to propagate vegetatively rather than by seed propagation. The latter method is liable to give rise to progeny which may not resemble the parent type, and in many orchard and plantation crops, such offspring can show considerable variation. Vegetative propagation, on the other hand does not produce a new type and can result in a large reduction in variability.

In the early history of tea planting, considerable variation in types of tea planted from seed was experienced, and, although the careful selection of seed bearers which is at present practised has reduced the variation considerably, it is now realised that methods of vegetative propagation might be usefully applied, mainly with a view to the establishment of uniform areas for seed production and experimental purposes.

The results obtained with the vegetative propagation of various temperate fruits, at the East Malling Research Station, Kent, by multiplying fruit-tree root stocks vegetatively in order to perpetuate races of known characteristics, suggested that the methods employed might be used in the tropics in the asexual propagation of hard wooded plants.

The article by Mr. J. N. Milsum, included in the present number, describes the etiolated shoot method of propagation which has given promising results with Tea and other economic plants at the Government Experimental Plantation, Serdang.

It has been found possible to cause shoots from collar pruned tea bushes to produce a large number of roots in the space of six months, by adopting a method of mounding the shoots with soil thereby causing the lower portions of the stems to become etiolated or blanched. A band of thin copper wire is then placed round the base of each shoot at a short distance above the point of emergence from the stump; the soil is replaced, and root formation occurs.

It is however realised that there are possible limitations to the practical application of asexual propagation of tea, and the results of future work in this connection, will be awaited with interest.

Flowering of the Nipah Palm.

The nipah palm (*Nipa fruticans*) is of some importance in Malaya not only as a source of supply of attap for roofing material, but also as a potential source of power alcohol and of sugar. References to this palm have appeared from time to time in the pages of this Journal, and the article by Dr. H. W. Jack, M.B.E., in the present number, is a useful record of observations made of the flowering characteristics of the palm under cultivation, on the plantation controlled by Messrs. Nipah Distilleries of Malaya, Ltd., Kuala Selangor, where for a number of years the commercial possibilities of the nipah palm have been under investigation.

Injury to Coconut Palms by Lightning.

A paper by Mr. A. Sharples, formerly Government Mycologist, Department of Agriculture, S.S. & F.M.S., which appeared in The Annals of Applied Biology Vol. XX, No. 1, February 1933, is reviewed in this issue of the Journal. The article is of importance to those interested in the coconut and rubber industries in Malaya, since it is the first complete and definite pronouncement on certain somewhat obscure pathological problems connected with diseases of the coconut palm and of the rubber tree in this country.

Owing to the fact that in the literature from other tropical countries, and in standard text books on coconut planting, references are made to diseases known as "bud-rot" and root disease, it has frequently been assumed that the cause of death of coconut palms in Malaya was due to attack by the fungi recorded as causal agents of bud-rot and root diseases in these other countries.

True bud-rot, has never been recorded on coconut palms in Malaya, and no definite root disease of coconuts has, so far, been found in this country.

The fungus *Phytophthora* has been shown to cause epidemic bud-rot of the coconut palm in India and in the Phillipines, but, although strains of this fungus are present in this country on rubber and other plants, the fungus has never been recorded on palms in Malaya. The symptoms of true bud-rot are first

evident in the central leaves and the spike. These leaves fall over and can be pulled out, revealing a foul smelling rot at the base due to decay of the bud tissue. The remaining older leaves remain green for a short period and then die, and death of the affected palm ensues.

Only one instance of a "disease" of the coconut palm in which these symptoms occurred, has been observed in Malaya, and on this occasion, it was found that the decay of the bud tissue had been caused initially by pellets fired from a shot gun.

Bud-rot of the oil palm is a well known disease on Malayan plantations, and in this disease one can usually find evidence of injury to the bud by mechanical or insect agency, and the disease differs from coconut bud-rot in that affected palms usually recover.

A definite parasitic micro-organism has not been found in association with oil palm bud-rot, and, in the case of coconut palms, no organisms have been found to be primarily responsible for the only form of "bud-rot" recorded in Malaya.

It has now been established that, in Malaya, the cause of this form of "bud-rot", which affects coconut palms, is injury by lightning. The symptoms of the "disease" do not resemble true bud-rot as reported from other countries, since the central leaves and the bud are usually only affected after the outer leaves have died.

In the article reference is made to the 20th Kelvin Lecture, delivered by Dr. G. C. Simpson, C.B., F.R.S., to the Institute of Electrical Engineers, on the subject of "Lightning". Dr. Simpson distinguishes three types of lightning discharge *i.e.*

- (1) within the cloud,
- (2) to the ground from a "positive" cloud,
- (3) to the ground from a "negative" cloud.

The characteristics of the two types of discharge to the ground are said to be very different *e.g.* No. 2 is of frequent occurrence but may be weak in effect, whereas No. 3 is infrequent but strong in effect. In consequence, it is possible to postulate a theory which affords an explanation of the occurrence, in Malaya, of frequent cases where small groups of 6—12 palms are killed, and of infrequent cases where a large group of over 100 palms may be affected.

Some interesting observations on the association of "claret coloured canker" at the collar of rubber trees slightly affected by lightning strike are recorded in the article.

While it has not been found possible to reproduce the entire article in this Journal, it is hoped that the somewhat extensive review included in the present number will provide useful information not only to the estate managers on whose properties lightning has taken an annual toll of palms or rubber trees, but also to those on estates which have been fortunate in escaping the serious damage which can be caused by lightning.

Original Articles.

THE RUBBER INDUSTRY IN MALAYA IN 1932.

BY

H. A. TEMPANY,

Director of Agriculture.

Economic Conditions.

The average price of rubber for the year was considerably below even the very low figure for 1931. Comparative prices per lb. for the year as against the 1931 figures in the three main markets in terms of the local currency are—London 2.30d. as compared with 3.13d; New York 3.40 cents gold as compared with 6.07 and Singapore 7.01 cents Straits currency as compared with 9.78. The greater discrepancy between the New York figures for the two years as compared with the London and Singapore figures is due to the departure of Sterling from the Gold Standard in September of 1931, from which date the London and Singapore quotations have naturally borne a higher ratio than before to the New York quotation. The average monthly prices in the three markets were as follows:—

TABLE I.

		Average Monthly Price per Lb.												
		Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Average for 1932.
* London	...	3.05	2.71	2.16	1.88	1.81	1.72	1.88	2.44	2.71	2.25	2.56	2.48	2.30
* New York	...	4.49	3.95	3.30	2.96	3.04	2.64	2.78	3.56	3.77	3.66	3.39	3.20	3.40
* Singapore	...	9.92	8.18	6.39	5.40	5.39	4.95	5.39	7.41	8.38	7.47	7.76	7.54	7.01

The general world position of rubber was briefly reviewed in last year's report and the statistical summary then given, taken from W. H. Rickinson and Sons "World Rubber Position", is reproduced below with the addition of the figures for 1932.

* New York = Cents of gold dollar.

* Singapore = Cents of Straits dollar.

* London = Pence.

TABLE II.

	World Production Tons	World Consumption Tons	World Stocks Tons	Average Price s. d.
1922	379,920	394,527	205,840	9½
1923	412,771	439,407	163,097	1 3½
1924	421,217	458,252	108,850	1 1½
1925	516,076	551,244	76,383	2 10½
1926	614,778	533,915	149,026	1 11½
1927	605,196	589,128	193,146	1 4½
1928	649,674	667,027	122,828	10 1½
1929	863,410	785,475	228,572	10½
1930	821,815	684,993	366,034	5 1½
1931	797,441	668,660	495,724	3½
1932	709,840	670,250	517,598	2 1½

It will be seen from the foregoing that the production in 1932 has fallen by 87,601 tons as compared with that in 1931, a decrease of 10.9 per cent.

The total world's stocks in 1932 amounted to 77.2 per cent. of the world's annual consumption as compared with 74.1 per cent. in 1931.

The sharp rise in price in August and September, representing an advance of over 45 per cent. within three months, merits attention. Various reasons for this have been suggested. It is evident that it was not caused by increased consumption or decreased stocks, and is possibly due to reaction from the most acute phase of the depression.

At the commencement of the year, negotiations were in progress between the English and the Dutch Governments for the purpose of exploring the possibilities of devising some satisfactory form of restriction of output, with a view to improving market conditions.

It transpired, however, as the result of these negotiations that no satisfactory solution of the problem could be arrived at in the circumstances then existing; an announcement to this effect was published simultaneously by the English and Dutch Governments in March 19th 1932.

The communiqué read as follows—

“The British and Netherlands Governments in association with representatives of rubber growers in British and Dutch overseas territories have been engaged in negotiations in order to see whether a practicable scheme for the improvement of the rubber situation could be devised. In the course of these negotiations the British and Netherlands Governments have consulted the Governments of Ceylon, Malaya and the Netherlands Indies. After a careful review of the

situation, the two Governments have been forced to the conclusion that under present conditions it is impossible to frame and operate an international scheme which would guarantee the effective regulation of the production or export of rubber."

Area Under Cultivation.

The distribution of areas under rubber in Malaya at the end of 1932 is shown in the following table—

TABLE III.

State or Territory.	Estates of 100 acres and over.			Estates under 100 acres.	Total Planted.
	Tappable Acres.	Immature Acres.	Total Acres.	Total Acres	Area Acres.
Perak ...	250,953	23,504	274,457	251,202	525,659
Selangor ...	308,379	33,758	342,137	155,125	497,262
Negri Sembilan ...	228,541	45,565	274,106	81,299	355,405
Pahang ...	38,141	21,643	59,784	75,973	135,757
Total F.M.S. ...	826,014	124,478	950,484	563,599	1,514,083
Malacca ...	111,780	8,426	120,206	74,912	195,118
Province Wellesley ...	44,734	6,162	50,896	19,826	70,722
Dindings ...	6,969	956	7,925	7,667	15,592
Penang ...	1,635	186	1,821	11,212	13,033
Singapore ...	28,269	2,392	30,661	12,781	43,442
Total S.S. ...	193,387	18,122	211,509	126,398	337,907
Johore * ...	313,385	145,757	459,142	341,613	800,755
Kedah * ...	—	—	194,708	106,460	301,168
Perlis * ...	—	—	2,274	4,926	7,200
Kelantan * ...	—	—	33,998	58,789	92,787
Trengganu * ...	—	—	10,000	20,000	30,000
Total U.M.S. * ...			700,122	531,788	1,231,910
Total Malaya † ...			1,862,115	1,221,785	3,083,900

* 1931 records. (The figures for 1932 are not yet available, but are not expected to be markedly different).

† (U.M.S. figures for 1931 are included in this total).

It will be seen from the foregoing that the total estimated area under rubber in Malaya at the end of 1932 was 3,083,900 acres; of this total area 1,862,115 acres are estimated to be in production on estates of 100 acres and over.

Production of Rubber in 1932.

The production of rubber in Malaya during the year 1932 was 417,137 tons of which 240,107 tons was derived from estates of 100 acres and over and 177,030 tons from holdings of less than 100 acres each. In 1931, the production was 434,857 tons of which 239,435 tons were from estates of 100 acres and over and 195,422 tons the production of holdings less than 100 acres.

Malayan production in 1932 is sub-divided as follows —

TABLE IV.

		Production of Estates 100 Acres and Over.	Production of Estates of Under 100 acres.
Federated Malay States	...	140,525 tons	93,371 tons
Straits Settlements	...	24,985 ..	24,877 ..
Unfederated Malay States	...	74,597 ..	58,782 ..
		<u>240,107 ..</u>	<u>177,030 ..</u>

The production of rubber from estates was almost identical for the years 1931 and 1932, while the production of rubber from estates of less than 100 acres each (small holdings, native owned) showed a decline in 1932 of 18,392 tons as compared with the previous year, a drop of 9.2 per cent., while total Malayan production shows a decline of 4.1 per cent. as compared with 1931.

The net exports of rubber in tons from Malaya, Netherlands India and Ceylon for the past four years were as follows —

TABLE V.

Malaya.		Netherlands India.*		Ceylon.‡
Rubber.	Latex.	Rubber.	Latex.	Rubber including dry weight equivalent of latex.
Tons	Gallons	Tons	Gallons	Tons
1929 415,608	1,709,529	254,816	2,455,990	80,639
1930 434,638†	815,486	234,223	4,879,350	76,315
1931 412,265	741,363	257,273	6,657,840	61,609
1932 401,530	1,757,002	211,241	6,174,000	49,080

Local consumption of rubber amounted to 2,395 tons in 1932, as compared with 1,521 tons in 1931.

Total stocks of rubber in Malaya at the end of 1932 were—at Ports 6,058 tons, dealers 49,189 tons, on estates 21,777 tons, a total of 77,024 tons, as compared with 96,677 tons at the end of 1931.

The area of new plantings is estimated to be as follows—

Federated Malay States	...	3,496 acres
Straits Settlements	...	144 „
Unfederated Malay States	...	— „ ‡

In accordance with the decision reached in 1930 no fresh alienations of land for rubber planting have been made during the year, and consequently any additional areas planted have been on lands already alienated.

During the year the low price of rubber gave rise to a general demand from owners of Malayan Rubber properties that a reduction should be made in the quit rents charged by Government in respect of lands alienated for cultivation of rubber. This demand was acceded to and on July 30th, at the opening of the Malayan Agricultural and Industrial Exhibition, His Excellency the High Commissioner announced the decision of the Federated Malay States Government to waive all current rents due on lands cultivated under rubber in excess of \$2 an acre. Similar decisions were made by the Government of the Straits Settlements and the Government of Johore, the condition of the waivers being that they applied to rents for the current year 1932 only (not to any arrears carried over from previous years) and to rents actually paid during 1932.

* As quoted in "Maandelijksche Rubber—Statistieken van Ned. Oost Indie" No. 61, 1930, No. 74, 1931, No. 86, 1932.

‡ As quoted in "Supplement to the "World's Rubber Position" January, 1933, published by W. H. Rickinson and Son, January, 1933. Separate figures for latex are not available.

† In the figure shown in this report for the preceding year no allowance had been made for wet weight of imports from Netherlands India. Correction has been made in the figure now shown.

‡ Not yet available.

Rubber Areas Out of Tapping.

The continued low price of rubber has been the cause of certain estates entirely ceasing to tap their trees, and for others to cease tapping certain areas—presumably the less productive areas.

On the other hand on many estates it is considered more economical to tap than not to tap as the loss occasioned in this way is not infrequently less than the cost of putting the estate on to a care and maintenance basis; the crux of the matter no doubt being the yield experienced.

There has been some slight tendency towards the abandonment of rubber properties and a number have been sold on account of failure to pay quit rent, the majority have, however, been bought up by other properties, and the general tendency throughout the industry has been, so far as possible, to maintain properties in a workable condition in the hope of eventual recovery.

The following is a comparison of the area out of tapping in Malaya at the end of December 1931 and December 1932—

TABLE VI.

Estates which have entirely ceased tapping.			Estates which have ceased tapping part of area.			
Acreage out of tapping.		Percentage of tappable Rubber out of tapping: to tappable Rubber.	Acreage out of tapping.	Percentage of tappable Rubber out of tapping.	Total area of tapping.	Percentage of tappable Rubber out of tapping.
December 1931	101,879	7.2	184,759	13.0	286,628	20.1
December 1932	141,448	9.9	173,377	12.2	314,825	22.1

In the latter part of the year, attempts were made to estimate the amount of rubber on holdings of under 100 acres in the Federated Malay States which were out of tapping. The result showed that of an estimated total of 510,000 acres of tappable rubber on small holdings in the Federated Malay States approximately 79,000 acres, or 15.5 per cent., were out of tapping.

When rubber prices reached their highest in August/September, there was a corresponding increase in the area tapped, but minor fluctuations in price caused no apparent corresponding variation in production.

Conditions on Estates.

The depression in the industry continued with increased severity throughout the year, and production has only been maintained at all by the exercise of the most rigid economy. Comparatively few estates have been able to carry on without actual financial loss, and in the rare cases in which it has been possible to make both ends meet the result has only been achieved when conditions in respect of yields are particularly favourable and by dint of sacrifice which must tell on the well-being of the industry and those connected with it. Remarkably low costs of production have been reached, in certain cases the minimum being as low as from 4--5 cents per lb. f.o.b.; but these must be regarded as the direct result of economies which are outside the range of practical politics under less stringent conditions. Nothing but very urgent upkeep services have as a rule been carried out, and great reductions have taken place in estate labour forces. During the year the Labour Department repatriated 56,471 Indian labourers and their dependents, while the importation of labour from India for estate requirements practically ceased.

All of these circumstances have combined to create a set of conditions which must be regarded as unstable.

It is, however, certain that the extremely stringent conditions which have prevailed during the past two years have opened up possibilities for production at costs which were undreamt of four years ago.

Under these conditions it is not surprising that progress in most directions connected with the agricultural side of the industry has been greatly retarded. Attention, for the most part has been concentrated on the possibilities of decreasing the cost of production by modifications of tapping systems, by the introduction of factory improvements and on the possibilities of increased consumption of the raw material.

On certain of the larger properties attention has continued to be paid to budgrafting and rejuvenation questions, the view being held that in the future those properties which have succeeded in raising their returns by the establishment of high yielding planting material are the most likely to survive.

A considerable amount of light has, in previous years, been thrown on the question of manuring rubber by experiments carried out in Malaya and in the Netherlands East Indies, but during the past year the low price of raw rubber has rendered the commercial application of fertilisers to rubber an uneconomic proposition.

During the year fertiliser trials have been continued on the Rubber Research Institute Experiment Station and on certain estates.

Some attention has been directed to the manuring of nurseries and, it is thought that this may be serviceable especially on poor soils, while young rubber manured in this way could be brought to bearing earlier. As a general conclusion the paramount importance of the nitrogen question has been emphasised and the view has been expressed that deficiency in this regard in the past has been the cause of many of the troubles experienced.

The practice of growing cover crops for the conservation of soil as well as the encouragement of growth of suitable natural covers is receiving considerable attention.

Experiments at the Rubber Research Experiment Station have shown that while leguminous covers definitely retard the growth of rubber during the early stages, the trees under such covers are now gradually catching up in growth. At a later stage, owing to soil deterioration on the clean-weeded areas, it is probable that the growth of the rubber trees will, on the cover crop areas, eventually surpass that of the trees on the clean-weeded areas.

The application of the so-called Forestry methods to rubber cultivation has been prominent during the year and there has been a good deal of discussion of the question in planting circles.

The subject was reviewed briefly in my last report but it cannot be said that a great deal has been added to knowledge of the question since then, save that it is becoming recognised that the extension of the principle involved of allowing natural growth to arise in rubber plantations may very easily be overdone.

The effect of allowing heavy secondary growth to arise has also been shown to create conditions favourable to the spread of certain diseases, particularly Mouldy Rot.

At the Rubber Research Institute Experiment Station, experiments have been in progress for some years past in which young rubber has been allowed to grow up in secondary jungle and under these conditions a definite retardation of growth has been shown to occur.

Work on budgrafting has continued to progress, although more slowly than hitherto, while systematic investigations in this respect have been continued at the Rubber Research Institute Experiment Station. A total of approximately 190 new clones have now been established at the Rubber Research Institute Experiment Station from high yielding Malayan mother trees selected on various estates.

It is estimated that at the end of 1932 there was a total area of approximately 95,831 acres of budded rubber in the Federated Malay States and Straits Settlements only, the figures for the Unfederated Malay States are not yet available.

Importations of budwood and superior planting material from the Netherlands East Indies and from other sources during the year were as follows —

Budwood	...	277 metres
Stumps	...	320 "
Selected seed	...	Nil.

These figures show a further very great decrease as compared with importations in previous years, attributable partly to the greatly increased popularity of budwood from proved Malayan clones or from known material raised locally in nurseries.

Information has continued to be accumulated regarding yields from various standard clones both of Malayan and Dutch origin planted under estate and experimental conditions. Certain clones have now demonstrated their ability to give yields of the order which were anticipated over appreciable areas, and the possibility of increasing yields of rubber by planting high yielding strains must now be regarded as having been removed from the realm of controversy.

Some attention has been paid during the year to the possibilities inherent in the budding of stumps of some size in the field, while investigations have also been made on the possibilities of test tapping of seedlings in nurseries with a view to ascertaining the probable future yields. A certain amount of work has been performed on bark renewal in certain selected clones and it has been found that in most respects results are satisfactory.

Increased attention has been paid to new systems of tapping with the object primarily of economising labour and therefore tapping costs. The so-called Sunderland system which originated in Ceylon is being tried out on a number of estates and the results of trials regularly examined by the Rubber Research Institute. It is contemplated to initiate further tapping experiments on mature rubber under the direct control of the Rubber Research Institute.

This work links up with plans for the study of the physiology of latex production, of which there is need if the question of extending the uses and application of rubber in industry is to be followed up successfully.

Work by the Rubber Research Institute on the artificial pollination of rubber has ceased for the time being although it is still being continued on at least one estate; a collection of material derived from work of this type has been established on the Institute's Experiment Station and this will be available for use in future years.

In relation to disease questions, considerable additions to knowledge have been made during the year regarding the incidence of the two principal root diseases of the rubber tree, *Fomes lignosus* and *Ganoderma pseudoferreum*. It is considered that, under uncontrolled conditions, these diseases probably constitute an important limiting factor to the life of rubber plantations, at any rate when they are first planted on newly cleared land. Latterly methods of treatment have been studied which it is hoped may lead to the possibility of eradicating these diseases if control operations are carried out at an early stage in the life of the plantation.

Conditions considered favourable to the outbreak of mildew disease of the leaf caused by the fungus *Oidium Heveae* were not recorded during the year so that it was not possible to carry out systematic experiments on dusting with sulphur for the control of the disease.

During the later part of the year, in certain quarters, attention was directed to the possibility that the disease might be more widespread than has hitherto been recognised and at the end of the year this assertion was being investigated.

Mouldy Rot disease has continued to occur throughout Malaya, particularly during the wet season. The position in relation to the control of this malady is rendered particularly difficult on small properties owing to the low price of rubber which precludes small holders applying remedial methods. On estates, remedial measures have continued to be applied but the possibility of infection from adjacent small holdings has proved a constant source of anxiety. There appears to be some evidence that strains of the disease possessing augmented virulence may be making their appearance.

Under the arrangements approved during the preceding year a number of new proprietary fungicides for the treatment of Mouldy Rot have been investigated by the Pathology Division of the Rubber Research Institute, with a view to their inclusion in the white list of fungicides approved for the treatment of the disease, which is maintained and published by the Department of Agriculture. As a result 4 preparations have been added to the list during 1932.

In relation to insect pests, further work on the treatment of white ants with Paris Green has been carried out, which demonstrates the utility of this material when applied under satisfactory supervision and with certain precautions. No satisfactory method of dealing with the cockchafer grub pest, reported on an estate in 1931, has yet been evolved. The pest has since been discovered on two areas on other estates.

In relation to the more economic production of rubber in the estate factory, considerable advances have been made by the installation of batteries of sheeting machines in column or line-ahead formation, the use of troughs and chutes to convey coagulum and the installation of coagulation tanks to produce a continuous sheet.

Batteries of six machines have been found to be capable of dealing with the output of estates of 5000—6000 acres.

On other estates it has been found possible to adapt and re-arrange existing machinery in order to effect improvements in output.

It must be realised, however, that on small estates, the economies effected may not warrant the installation of new machinery and that the full benefits are only derived when such machinery can be used for a large area by centralising the factories. It is visualised also that it may be possible to prepare a pale sheet rubber which can be used as a substitute for pale crepe thus eliminating heavy machinery except for the treatment of the 10—15 per cent. of lower grades.

A number of estates are now preparing air-dried sheet in place of smoked sheet. Considerable attention is being paid to more economic methods of drying and smoking, particularly in relation to better control of the supply of heat and the ventilation of drying and smoking rooms.

During the year, considerable interest has been taken in the export of latex and methods of concentration of latex for export in this form,

Until recently, latex concentrated in centrifugal machines and latex concentrated by evaporation in the presence of a stabiliser (Revertex) have been the only two types of such concentrates prepared in and exported from Malaya. Both of these processes are protected by patents.

The demand for both ordinary latex (dry rubber content 35—40 per cent.) and concentrated latex (dry rubber content 55—60 per cent.) is increasing, due both to the substitution of latex for raw rubber in certain articles already manufactured and also to the extending application of latex to new uses.

A publication on the preservation and shipment of latex has been issued by the Rubber Research Institute and much interest is being taken in the possibility of the increased production of latex.

Further investigations on the non-caoutchouc constituents of latex have been carried out by the Rubber Research Institute together with work on the effect which they exercise on the vulcanising and other properties of raw rubber, and attempts made to find a possible use and market for quebrachitol, considerable quantities of which have been isolated from latex serum.

Small Holdings.

The system of surveys and quarterly reports published in the *Malayan Agricultural Journal* on conditions on small holdings begun last year has been continued.

Data collected by the Statistical Division of the Department of Agriculture and the Department of Statistics, Federated Malay States and Straits Settlements, places the production of rubber on small holdings during the past three years at the following figures —

TABLE VII.

		1930	1931	1932
		Tons	Tons	Tons
Federated Malay States	...	110,206	105,378	93,371
Straits Settlements	...	38,770	25,346	24,877
Unfederated Malay States	...	66,113	63,698	58,782
		<u>215,089</u>	<u>194,422</u>	<u>177,030</u>

It will thus be seen that production on small holdings shows a diminution which amounts to 7.25 per cent as compared with 1931 and 17.7 per cent as compared with 1930.

Corresponding figures for the production of rubber from small holdings in the Netherlands East Indies are as follows —

1930	1931	1932
88,920	89,736	62,381

The investigation into the questions of tapping practice on small holdings, bark reserves and rate of bark removal and bark renewal are nearly completed and it is expected that the final analysis of figures will be completed in time for publication of the information obtained during the first half of 1933.

The figures obtained from lots of 100 consecutive trees on the 75 holdings show that the average monthly rate of bark consumption amounts to 1.64 inches of vertical bark on a quarter circumference tapping cut. The average amount of reserves of tappable bark, below a standard height of six feet from the ground, remaining per tree at the end of the period of observation, is shown to be 145.75 vertical inches of one quarter circumference in width, or a little more than half the surface of bark below six feet from the ground.

It will be seen then that the average amount of existing bark reserves will permit of a continuation of tapping work under the conditions obtaining during the period of observation, without making any allowance for the factor of bark renewal, for a period of seven years and five months.

Since the average age of the trees on the 75 holdings under observation is found to be very nearly 16 years and allowing for the trees having been brought into tapping at the age of 6 years, it will be seen that bark renewal has so far been at a sufficient rate to allow for 10 years of almost continual tapping.

The severity or otherwise of tapping varies in different localities and is influenced very largely by the extent to which the owner has other means of livelihood. Hence in the vicinity of padi areas heavy tapping is less common than in localities where large areas of small holdings exist with rubber as the sole crop. Furthermore, such of the small holding rubber in the vicinity of padi areas is periodically rested when padi cultivation operations are in progress.

Even under the very low prices ruling, severe tapping is confined to a restricted number of localities where owners are unusually badly circumstanced; generally speaking, methods of tapping on small holdings are far less ruthless than they were a decade ago.

As usual, the prices quoted by the very large number of local buyers for small-holders' rubber exhibit a very great range. The main factors concerned, apart from the quality of the rubber, are the extent to which transport facilities are developed and the degree of competition in respect of each buying centre.

As an example of the price range existing, the following quotations from various States and Settlements for small-holders' smoked sheet in Straits dollars and cents per picul are reproduced from the December reports of Agricultural

Officers—Kedah 8 to 10; Province Wellesley 6.70 to 10; Perak 6.50 to 9; Selangor 6 to 9.25; Negri Sembilan 7 to 9.25; Malacca 8 to 9; Pahang 6 to 9.20.

Reference to an earlier statement will indicate the position at the end of the year in the matter of areas out of tapping. There is a good deal of fluctuation in this respect, sometimes due to a change in price, but more largely influenced, in areas where padi is grown, by the claims this latter crop has on the owner. In respect of price influence, it may be recorded that the rise of price in August resulted in increased tapping in some parts, especially where rubber constituted almost the sole crop.

There has been no general tendency to replace rubber by another crop, but a number of instances exist where a small-holder has cut out a small percentage of his poorest rubber with the object of utilising the land for growing sufficient foodstuffs for his own needs. This applies more particularly to areas where other land is unobtainable for the purpose. Such old rubber land generally needs manure to enable it to grow foodstuffs and the Agricultural Department has rendered assistance by advice and demonstration in a certain number of instances where the land owner has experienced difficulties in the matter.

The area newly planted on small holdings during 1932 amounted to 1,875 acres in the Federated Malay States and 52 acres in the Straits Settlements.

General.

During the year much attention has been directed to the question of finding new and extended uses for rubber.

The Rubber Growers' Association, assisted by a grant of £100,000 spread over a period of ten years from the Federated Malay States Rubber Research and Propaganda Fund, has undertaken an extensive series of investigations in this respect.

The work in England carried out by the Research Staff stationed at the Imperial Institute has been continued; the cost of this, which was formerly borne entirely by Ceylon, has since the commencement of 1932 been divided between Ceylon and the Rubber Research Institute of Malaya. It aims at establishing a link between the planting interests concerned with the production of rubber in the East and the manufacturers at home.

Particular attention has been directed both in the East and in Europe to the possibilities inherent in rubber road making and paving materials.

Trial stretches of road treated with various form of rubber mix have been laid down in the East and also in Europe, while in England and in France several street areas paved with rubber blocks are under observation.

PROPAGATION OF TEA FROM ETIOLATED SHOOTS.

BY

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Senior Assistant Agriculturist

and

T. D. MARSH,

Assistant Agriculturist.

Introductory.

While on leave in England during 1932, one of the writers (J. N. M.) was given the opportunity by the Director of the Imperial Bureau of Fruit Production to examine the work conducted at the East Malling Research Station, Kent, with the vegetative propagation of various temperate fruits. The investigations at that station have been concerned primarily in the determination of methods of multiplying fruit tree root-stocks vegetatively in order to perpetuate races of known characteristics. The results obtained have been published in detail (1). It was evident to the observer that the methods employed might, with some modifications, be used in the tropics in the asexual propagation of a variety of hard-wooded plants. Steps were taken, therefore, during the latter part of 1932 to test these methods under Malayan conditions.

The following plants are now under experiment,—rambutan (*Nephelium lappaceum*), pulasan (*Nephelium mutabile*), lime (*Citrus medica* var. *acida*), citrus varieties, chiku (*Achras sapota*), rubber, tea, and coffee. Successful results have so far been obtained with tea, various citrus trees and pulasan. Since it has been demonstrated that tea shoots may be induced to root readily by this new method of propagation, it is proposed to publish the results to-date.

Methods of Vegetative Propagation.

There are a variety of methods employed in propagating plants vegetatively, namely hardwood and softwood stem cuttings, root cuttings, stools, layers, grafts and marcots. With regard to marcotting this method is commonly undertaken in Malaya in raising fruit trees of desirable quality and a marcot, which is known as a 'tut' to the Malay in this country, consists of 'ringing' a branch, covering up the ringed portion until adventitious roots appear, when the rooted branch is placed in a receptacle containing soil (2). From a practical standpoint, the method just described is unsuitable in the case of many plants including the tea bush, whilst poor results are obtained from cuttings.

Various systems of budding and grafting have been employed in Java (3). The usefulness of these methods of propagating tea is in the establishment of uniform areas for seed production and experimental purposes. Uniform stocks are, however, necessary since seedling stocks produce variations in the characters of the scions grafted upon them.



ETIOLATED TEA SHOOT.

Showing root system above wire band,
six months from collar pruning.

Layering is successful, but is a slow and expensive method. It is stated to be most satisfactory with the 'China jat' type of bush and is extensively employed in Formosa in maintaining the special characteristics of oolong teas (4).

Basing the method of propagation on that undertaken with apple stocks at the East Malling Research Station, it has been found possible to cause shoots from collar-pruned tea bushes to produce a large number of roots in the short space of six months. The principle involved in propagation from stools is the production of a number of shoots from the pruned stump which under suitable conditions produce roots at their bases. The necessary conditions are obtained by mounding up the shoots with soil which causes the lower portions of the stems to become etiolated or blanched. To ensure rapid root formation the soil is then removed and a band of thin copper wire placed round the base of each shoot a short distance above the point where it emerges from the stump. The soil is then replaced when root formation occurs, presumably as a result of stimulated callus formation and a reduction of hard, fibrous tissue in the cortex of the shoot, as a result of etiolation.

It is recognised that modifications of the method employed may eventually be found advantageous in the propagation of tea. Further, it is appreciated that there are possible limitations to the practical application of asexual propagation of tea since it is generally stated that the development of a strong tap-root is necessary with this crop. This may be obtainable only from seedling plants.

With regard to citrus it appears probable that the layering system, as undertaken at the East Malling Research Station with plum and cherry stocks, will be found of practical utility. Preliminary results at the Experimental Plantations at Kuala Lumpur and Serdang give promise of satisfactory results from this method. Success with citrus and *Nephelium* species has been reported from Ragoenan Experiment Station, Java (5). Satisfactory results have also been obtained in Java in propagating tea (6). In this method the plants required to be propagated are planted in rows obliquely at an angle of 35 degrees to the horizontal. When sufficiently established the young trees are laid and pegged down in a shallow trench several inches below ground level. As shoots appear from the main stem and lateral branches, an inch or so of fine soil is placed over the entire tree. The growing shoots have thus to ascend through the layer of soil. As growth proceeds, further soil is added, until a layer of earth 4 to 6 inches in depth covers the base of the shoots. The portion of the stem below the soil receives no light and becomes etiolated. This condition is favourable to rooting which occurs freely in the blanched portion of the stem of the shoot below the soil.

This method of propagation appears generally more suitable for use in temperate countries where the operation of pegging down deciduous trees during

winter is a comparatively easy matter. The return of growth in spring results in the production of vigorous shoots which push readily through the soil. In the tropics where growth is more or less continuous it is a more difficult matter to induce free growth after the trees are covered with earth.

Propagation from Tea Stools.*

Twenty tea bushes planted as seedlings in the field in November, 1929, at the Government Plantation, Serdang, were collar pruned to the surface of the soil in October, 1932. Within a month's time a number of shoots made their appearance. The average number per bush was five although additional shoots appeared later. Surface soil was then drawn round each stool and the base of the shoots covered with earth to a depth of 4 to 6 inches. Early in January, 1933, the soil was removed from all the stools and a band of wire placed round the base of each vigorous shoot. By the middle of April, i.e. six months after the tea bushes were collar pruned, it was found that a large number of the shoots had produced strong roots. An average number of three rooted shoots were removed from each stool, and many others were found forming roots. These were transplanted into bamboo joints and suffered no ill effects from being severed from the parent bushes. Rainfall during the whole six months was fairly heavy there being only one dry spell of about two weeks in February. The illustration shows a typical shoot with its rooting system. It appears probable that, by selecting older tea bushes with a vigorous rooting system, a considerably larger number of shoots might be produced after collar pruning.

A further consideration is the question of starch reserves of the tea bushes to be collar pruned which undoubtedly is an important factor in the production of a number of vigorous shoots. A high starch reserve is obtained by ceasing to pluck the tea bush for two to three months before pruning.

Conclusions.

The etiolated shoot method of propagation affords opportunity for the rapid increase of desirable clones of hardwood plants. Preliminary work conducted by the Department of Agriculture has given promising results with tea, and a variety of economic plants are under experiment. Further work is necessary to determine whether such rooted tea shoots will prove as satisfactory as seedling plants in the field. The work conducted at the East Malling Research Station opens a wide field of possibilities in plant propagation which now remains to be applied under tropical conditions.

* Since this paper was submitted for publication, a summarised translation of Wellensiek's paper in *De Bergcultures*, 1932, 6, pages 778—81 has become available. Similar results to those now published are recorded and the wire ring propagation method with tea in the Netherlands East Indies is shown to be very successful, thus confirming the results obtained under Malayan conditions.

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NOTE ON THE FLOWERING OF THE NIPA PALM UNDER CULTIVATION.

BY

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Economic Botanist.

So little was known of the flowering characteristics of the nipa palm (*Nipa fruticans*) under cultivation or under natural conditions that an attempt was made to collect some information in 1931.

Records of the sequence and duration of the various stages in the opening of the flowers under natural conditions were made at Titi Serong Padi Experiment Station, but the observations were unsatisfactory since the palms under scrutiny had been subjected to heavy periodical prunings for the purpose of collecting leaves from which to make "attap" so that flowering was obviously weakened and retarded. Nevertheless, those observations showed that self-pollination occurred naturally but that cross-pollination, either by wind or through the agency of insects, was the more common mode of fertilization. Large ants ('keranga', *Occophylla smaragdina*) were the only obvious insects present in numbers sufficient to effect the pollination of the opening female flowers but possibly night flying insects were also plentiful though no record of their presence was made.

Unfortunately the particular palms used for those observations had to be destroyed before further records could be collected and a second series of observations, which was started near Klang, was abandoned because the palms were continually being defoliated by "attap" weavers. Subsequently the study of the flowering features of the palm, especially with a view to ascertaining definitely the possible advantages of artificial pollination under estate conditions as affecting the yields of juice, became an important problem. The General Manager of Nipa Distilleries of Malaya Ltd., was approached and kindly agreed to permit his staff to co-operate in the collection of the desired information on that Company's estate in Selangor. A list was made of suggested observations aiming at the attainment of information to define (1) the agency or agencies of pollination, (2) whether self-pollination was possible, (3) whether cross-pollination was normal and (4) whether artificial pollination was practicable.

Suitable isolation cages for the bagging of flowers were supplied to the estate and observations were inaugurated and carefully carried out by the estate staff on 24 palms, half of the number being situated on 'lenggaddai' (*Bruguiera parviflora*) land and half on 'piaí' (*Acrostichum aureum*) land. The palms were approximately 10 years planted and were representative of the different

conditions, as regards soil and water supply, found on the estate. The observations extended over a period of 6 months and can be summarised as follows :—

- (1). The flowering sheath from its first appearance, takes 4—6 weeks to reach a length of approximately one foot.
- (2). From this stage to the opening of the male flowers, there is a variation from 14 to 27 days with an average of 21 days.
- (3). The duration of the male phase of flowering varies from 4 to 10 days according to weather conditions. In hot dry weather, this phase lasts for 7 to 10 days while in cool, moist weather all the male flowers opened in 4 to 5 days.
- (4). The female flowers remain receptive for 7—8 days and invariably commence to open 1—2 days before the male phase begins.
- (5). The fruit is ready for the "Gonchang" (binding and beating to accelerate juice exudation) period approximately four months after the beginning of the female phase.
- (6). The total time required for the maturation of ripe fruits (untapped) from the beginning of the male phase is approximately 6 months.
- (7). There was no apparent difference in the various phases of flowering whether the palms were grown on 'lenggaddi' or on 'piai' land.
- (8). Artificial pollination, while not strictly necessary, appears to be beneficial in that artificially pollinated heads are more uniform in size and larger than those derived by natural means of pollination. Further, fewer heads dry up or fail to come to maturity in the case of artificially pollinated heads.
- (9). Artificial pollination is practicable, and was established in practice on the estate.
- (10). No particular insects were observed to have effected pollination and it was taken for granted that wind was the chief pollinating agent.

This completes the summary of the observations then made but it should be mentioned that in connection with the last point, (pollination), numerous insects have been recorded as found in the vicinity of nipa palms by Mr. G. H. Corbett, Government Entomologist, S.S. and F.M.S. though no reference to them as pollinating agents has been made.

In 1931 Corbett* reported the presence of an anthomyiid fly (*Phaonia Corbetti*) as a serious pest of the male flowers of this palm and it is possible but unlikely that this fly may play some part in pollination.

This brief summary is intended to preserve a record of the observations which were compiled, and thanks are due to the General Manager of Nipa Distilleries of Malaya Ltd., for his consent to the publication of the information obtained.

* *Malayan Agricultural Journal*, Vol. 19, 1931, page 37.

Reviews.

Lightning Storms and their Significance in Relation to Diseases of (1) *Cocos nucifera* and (2) *Hevea Brasiliensis*.

By A. Sharples.

(From The Annals of Applied Biology Vol. XX. No. 1. February 1933.)

The Coconut palm in Malaya has never been associated with the attack of virulent parasitic fungi capable in themselves of causing the death of a palm. The literature on diseases of Coconut palms in other tropical countries is fairly extensive, and a study of such literature will reveal that there is one form of disease which is fatal and which is considered to be due to the direct attack of micro-organisms, viz :—bud-rot.

In the article under Review, the writer— Mr. A. Sharples, formerly Government Mycologist in the Department of Agriculture S.S. and F.M.S.— gives a clear exposition of the work on Bud-rot of Coconut and other palms in the countries where this disease has been studied, and it is explained how the term Bud-rot has been rather loosely applied to various maladies of the Coconut palm which frequently end fatally.

Workers in other countries have established the connection of the fungus *Phytophthora palmivora* Butl. with an epidemic disease of coconut palms in which the heart leaves, or central spike, turn brown initially and then die and fall over, while the remaining leaves remain green and healthy for a time. The palms, so affected, do not recover, because all the meristematic tissue, concentrated in the bud, presumably is killed and further growth does not take place.

Symptoms of "bud-rot" in coconut palms in Malaya differ from those described from other countries, where the fungus *Phytophthora* is connected with the disease, in that the central leaves and spike are not as a rule noticeably affected until the outside, older leaves have died. It is therefore not strictly correct to term the local malady "bud-rot", and the writer of the article under review, presents evidence which indicates that normally, in Malaya, the primary initiating cause of "bud-rot" of the coconut palm is injury by lightning. There is no evidence in Malaya up to date to show that a *Phytophthora* sp. is associated with the problem as a causal agent.

It is interesting to record that a form of true bud-rot of the oil palm occurs in Malaya, but here again the disease differs from true bud-rot of the coconut palm in that affected palms, although showing the typical symptoms of collapsed central leaves and foul smelling bud tissue, normally recover and produce a new crown of central leaves. In the Reviewer's experience cases of bud-rot of oil palms are frequently associated with injury to the bud tissue by insect or by mechanical injury. In this connection it may be remarked that symptoms resembling bud-rot were produced artificially in Coconut palms in Malaya

following mechanical injury to the palms in the neighbourhood of the bud tissue (Sharples A. and Lambourne J., *Annals of Botany* XXXVI.), but no definitely parasitic fungus was found to be associated with the resulting decay.

The article describes the typical forms of injury to the coconut palm as a result of lightning strike. It is stated that the areas affected can be divided into

(a) Small areas, of common occurrence.

(b) Large areas, of rare occurrence.

"The typical cases, locally known as bud-rot due to lightning strike, show a group of 10—12 trees, of which one, two or three central trees die rapidly; on examination the bud tissues are found to be in a badly decayed condition. The surrounding trees show disease symptoms of varying intensity, *e.g.* stem bleeding, broken and hanging outside leaves, with the central leaves and spike still standing erect. When left untreated some of the slightly affected trees gradually grow worse and finally succumb.

"The leaf symptoms on the slightly affected trees can be conveniently described here. The broken leaves are found in some cases with the break taking place about 2 ft. away from the distal extremity, so that the tip of the leaf hangs down. Such damaged leaves are termed "tipped". Others show the break taking place about the point where the basal leaf pinnae join the petiole, about 3—5 ft. from the stem, and the whole of the leaf stalk carrying the leaf pinnae hangs down. "Broken" leaves is a convenient term for such leaves in contradistinction to "tipped". Leaves breaking away from the stem at the base but remaining attached and hanging against the stem are termed "hanging" leaves.

"(b) Large areas affected by lightning. The large areas of affected palms, groups in which over 100 diseased palms may be found, are of very rare occurrence. The first was examined in 1923, when 80—100 palms were found showing symptoms exactly similar to affected palms in the small patches. On the same estate in 1926 a larger area, showing between 200 and 300 affected trees, was found. This incident caused much concern, because of the possibility that the area affected in 1926 might be considered a reinfection from the 1923 area.

"In dealing with this outbreak great precautions were observed to prevent spread as a result of diseased tissues being transported down the drains. The possibility of a severe root infection could not be ignored, and the usual isolation methods were recommended. The area was trenched off and no fresh cases of diseased trees have yet been reported outside the isolated area."

In 1928 a questionnaire asking for information in connection with lightning storms was sent to a number of estates and from reports received, and from examinations made, it was concluded that lightning is the cause of death of palms in cases where groups of 6—12 palms were affected, and that there is no reason to fear the spread of disease owing to the presence of a parasitic organism.

The article presents a theory of lightning discharge and its significance in disease problems on Malayan coconut plantations, which might with advantage be quoted in full.

" As mentioned above, the symptoms shown by the affected palms and the "sequence of events so far met with in the larger areas are exactly similar to "those found in the smaller areas where the evidence for regarding lightning "as the primary initiating cause is so strong. Lacking a satisfactory explanation "the only cause for congratulation was that the large affected areas occur only "at rare intervals. Three have been studied up to date, one in 1923, one in "1926, both of which occurred on the same estate, and one in 1928. In 1929 "the Twentieth Kelvin Lecture was delivered before the Institute of Electrical "Engineers by Dr. G. C. Simpson, C.B., F.R.S., and his subject was "Lightning". "The lecture had many points of interest in view of the the position in Malaya "with regard to lightning strike and bud-rot of palms.

" Dr. Simpson in his exposition distinguishes three types of discharge :

- " (1) The discharge within the cloud.
- " (2) The discharge to the ground from a positive cloud.
- " (3) The discharge to the ground from a negative cloud.

" He states that the two latter are of most importance to the electrical "engineer, for it is these which strike buildings and overhead wires and do "structural damage.

" The characteristics of the two types of discharge to the ground are very "different. The discharge from a positive cloud starts high up in the atmosphere "and branches out on its way to earth. An earth-connected object may there- "fore be struck either by the main "trunk" or by one of the "branches". On "the other hand, a discharge to a negative cloud starts on an earth-connected "object which takes the whole discharge. Thus the chances of being struck are "much greater with a positive discharge than with a negative discharge.

" The theory leads to the conclusion that discharges from positively "charged clouds would be frequent but weak, while discharges from negatively "charged clouds would be infrequent but very strong. Dr. Simpson stated a "further conclusion, i.e. that there are at least four times as many discharges "between positively charged clouds and the ground as between negatively "charged clouds and the ground, and that there are good reasons for believing "that the ratio is nearer 10-1 than 4-1.

" Applying these conclusions broadly in relation to lightning strike on "coconut palms two important points are immediately obvious. Discharges "from positively charged clouds will be frequent but weak. These frequent "but weak discharges can be considered as responsible for the numerous small "groups of palms killed during practically every month of the year; in connec- "tion with these conclusive evidence has been obtained of the direct connection "between the typical symptoms and lightning.

" Discharges from negatively charged clouds will be infrequent but strong. "These infrequent but strong discharges allow a convenient and fitting explana-

"tion for the occurrence of occasional large areas of coconut palms being killed out, although there is no direct evidence of the connection between the two. The symptoms shown by the affected palms in the small and large areas are so exactly alike that only one conclusion can be drawn and that is that the causal agent is the same in both cases. Until the appearance of Dr. Simpson's paper caution was necessary in the absence of any direct evidence or fitting explanation, but now that the phenomena experienced on coconut plantations can be fittingly connected up with physical phenomena there seems no reason to doubt the adequacy of the explanation. Many diseased areas have been investigated personally, and the general trend of events is found to be similar in all.

The conclusion can be stated with absolute definiteness that lightning is of primary importance in the causation of disease on plantations of *Cocos nucifera* in Malaya. This statement gains added point from the fact that not only is lightning the source to which false bud-rot has been traced but definite evidence has been obtained to show that it must be considered to be the initiating cause of many cases of stem bleeding and root disease of coconut palms. The symptoms of these diseases have been found to be purely secondary, appearing in trees lightly but not visibly affected by lightning on some previous occasion".

With regard to the effect of lightning on the rubber tree the writer groups his observations under two headings

(a) Lightning effects and "die-back" usually found in young trees.

(a) Lightning effects and "claret-coloured bark canker at the collar" found on trees from 4 to 20 years of age.

The record of the association of a fungus—*Pythium* sp.—closely related to the fungus *Phytophthora*—in a disease of the rubber tree initiated by lightning strike, is of particular interest, especially in view of the fact that the fungus *Phytophthora* has not so far been found associated with lightning strike in local coconut palms.

The writer suggests that it is probable that the reason why a species of *Phytophthora* has not been obtained from bud-rot of palms in Malaya is that no strain of *Phytophthora*, capable of attacking palms, is present in Malaya, but, on account of the known possibilities in *Phytophthora* of producing variants from a parent type by dissociation, it is considered not improbable that, in the future, a *Phytophthora* sp. may be found as a causal agent in connection with bud-rot of palms in Malaya.

(A. T.)

Annual Report Tea Research Institute of Ceylon 1932.*Bulletin No 10.*

The Annual Report for the year 1932 contains under its various headings matters of great importance to all who are interested in the Tea Industry, particularly as at the present time, tea, like all other primary products is suffering from the effects of the prevailing world depression in commodity prices.

It is of interest to note that advisory work has expanded very considerably, which is conclusive evidence that planters are appreciative of the benefits gained from the work of the Scientific Staff. The greatest interest shewn related to methods of manufacture, which suggests that good use is being made of the Institute, with the definite object of improving the quality of the tea marketed.

The portion the report dealing with withering will be of particular concern to tea planters, as it is now realized that withering is of very considerable importance in deciding the final quality of tea. Results from experiments conducted during the year under review, proved that the period of withering has a marked effect on the tea made; withering for 14 - 20 hours producing a different grade of tea compared with that made by lengthening the period of wither to 36 - 40 hours, in the former case more colour being obtained in the liquors, and pungency, quality and flavour being lost in the latter. The full results of experiments carried out are shewn in Table V, (Effect of Withering on the Tea Made); whilst in Table VI, the effect of degree of wither can be seen. The value of these experiments cannot be over emphasized and they should prove of real interest to all tea growers.

Further it is shewn that micro-organisms play an important part in the manufacture of good quality tea. Experiments indicated that these are in the main detrimental, and absolute cleanliness during manufacture is considered essential in order to avoid the risk of taints developing in the tea, through contact with stale leaf from a previous batch. This appears to dispose of the former theory that fermentation was largely dependent on the presence of micro-organisms on the fermenting floors.

In the Field Branch various experiments have been carried out, several with a view to further economy in costs of production and others to increase knowledge of the effect of pruning in relation to yields.

During a course of manurial experiments it has been shewn that provided green manuring is carried out to a sufficient degree, good results should be obtained from the use of inorganic artificials. This finding, if substantiated, is of importance in view of the bias against these manures in the past. Special pruning mixtures have been used for many years, but this practice is no longer advocated, it is now being advised that a mixed manure be employed throughout the pruning cycle. With a view to finding the most satisfactory green manures and cover crops the Agricultural Chemist conducted field trials, this work being considered of sufficient importance to warrant continuance in 1933; the results of these trials should prove of value to the industry.

On small-holdings an endeavour was made to direct the owners along established lines in the cultivation of their lands. Demonstrations were arranged in the villages and great interest was evinced by the villagers, good progress in all works being reported by the Small-Holding Officer.

The Balance Sheet of the Institute suggests that the ultimate development of its programme of work, depends largely on market conditions for tea during the next few years, as the imposition of any form of restriction will certainly reduce its future income.

W. G. H.

RUBBER GROWERS ASSOCIATION.

Twenty-fourth Report of the Council.

The report of the council of the Rubber Growers Association which was presented at the ordinary general meeting in London on April 26th 1933, contains much information of interest especially in the reports of the various committees.

The section of the report dealing with the work of the "Technical Research and Development of New Uses Committee" records progress in relation to the use of rubber in linoleum, textile finishes, paints and highway surface construction, and mention is made of investigations carried out on deodorisation of vulcanised rubber and its use in hose and rubber lined containers, rubber insulation etc. in the manufacture and handling of food stuffs and in connection with ebonite partitions. An investigation into the use of rubber as a jointing material and oil and petrol resistant rubber is also noted. It is stated that the literary portion of a handbook for the use of engineers, chemists and physicists, containing physical and technical data likely to be needed in structural design, was expected to be completed by the end of June 1933.

With a view to widening the use of rubber in (for example) the building, decorating, upholstery, chemical trades etc., research work on "modified rubbers" has been commenced.

The Committee communicated with a number of Universities and Colleges calling attention to rubber as a suitable subject for research, particularly for postgraduate students.

The Committee decided to enlist the co-operation of the Rubber Research Organisations in Malaya and Ceylon, the Departments of Agriculture, in these countries, the Proef Stations in the Netherlands East Indies, and the International Rubber Association (Holland), in further research on latex, particularly

with regard to bulking latex on estates, suitable containers, standard qualities for export, improved processes of preparation on estates, as well as fundamental research on the physical and chemical properties of latex in the natural state, and also when subjected to varying temperatures, pressures and chemical reagents.

In connection with the preceeding enquiry the Committee suggested that co-operation in all technical research investigations could be best effected by the establishment of an International Committee in Europe in close contact with a corresponding organisation in the East.

The Report of the Propaganda Committee gives an account of the Exhibitions at which displays were made, and of publicity given to the uses of rubber in rubber-flooring, upholstery, automobiles, railway rolling stock, textiles etc., both at Exhibitions and through the medium of descriptive pamphlets and other publications.

(A. T.)

Stock Farming in the Tropics.

Comments on the Report on Cattle Breeding in Jamaica and Trinidad,
by John Hammond, School of Agriculture, Cambridge. Empire
Marketing Board 58. August 1932. Printed and published
by His Majesty's Stationery Office, London. 66 pages
and 65 illustrations, price 1/- nett.

This publication is particularly interesting as research on stock raising is being carried out on many similar lines in these countries as at the Government Stock Farm, Serdang, and the results obtained so far are in many respects similar. A few comments on the work and results at Serdang are incorporated in these notes.

The bulletin covers a general survey of cattle raising in Jamaica and Trinidad. Comments are made on the suitability or otherwise of various European breeds in these environments and includes the results to-date of cross-breeding experiments with Indian and West Indies mature cattle.

The policy adopted at the Government Stock Farm, Trinidad, is practically identical to that at Serdang. The present size of the Dairy Farm at Serdang, with the limited number of cattle available for experiments in breeding, only permits of the production of a very few specimens of each cross, making it difficult to judge the merits of each cross owing to individual variation.

The practice of infecting cattle, newly imported into Jamaica, with tick fever (piroplasmosis), and their subsequent treatment with trypan blue in endeavours to immunise them against further attacks, is illuminating. In this respect a heavy mortality has occurred in Malaya in imported grade cows in milk of European breeds, mostly from Australia.

It has been found that actual periodic dipping of animals, to prevent attacks of tick fever, is essential in Jamaica, whereas in Trinidad, as at Serdang, spraying has been found to be efficacious.

Of the Indian breeds of cattle observed in the West Indies, the Montgomery breed is considered by the writer to be the best for milk and meat qualities. The Mysore is probably the most suitable for draught, the Hissar or Nellore breed is considered to carry the combined qualities of work and milk production.

It is inferred from the above that these breeds are considered the most suitable for infusing their particular good qualities into their offspring when used for cross-breeding with local heterogeneous cattle, especially so when hardiness, disease resistance, and the ability to thrive under adverse tropical conditions are the characters desired, and the aim is improvement more or less by selection without the introduction of European blood.

Some authorities criticise the practice of cross-breeding European stock and "Zebu", on the grounds that the characters are so diverse that segregation takes place and results in the breeding often of nondescript degenerate animals having little utilitarian merit in any category. The writer contends that the characters of constitution and milk yield are multiple ones, in contrast to the fancy points such as colour, horns, etc. and there appears to be a useful blending instead of the possible splitting up as suggested by the Mendelian theory into the dominant and recessive characters. Apparently the slow rate of breeding of Indian cattle in the West Indies is an important economic factor. The writer of the article refers in particular to cows sired by a Nellore bull.

At Serdang the same difficulty has occurred with the Sahiwal (or Montgomery) cows and it is apparently due to the inherent characteristics of these cattle. It has been observed at Serdang that cows do not show signs of being in oestrus until several months after calving, and, should an isolated one become incalf earlier than usual with these breeds, her milk yield will fall off and she will have a low total yield during that particular lactation; in other words cows will not continue to milk after becoming incalf.

The general impression formed of the means of improving the stock of Jamaica is by an infusion of European blood and the use of cross-bred bulls is recommended. At the same time it is stated that there appears to be no reason, except the time factor, why an upgrading of native cattle could not be carried out to produce good results.

In Trinidad, of the European breeds, Friesians have given the best results when used for cross-breeding to infuse desirable characteristics into the offspring of the heterogeneous cattle of the Island, and the policy now adopted at the Government Stock Farm is to use for this purpose bulls of this breed only.

The experiments that have been conducted to ascertain the best admixture of Montgomery and Friesian blood for milk production combined with tropical disease resistance, and the ability to thrive and milk well in the tropics indicates that $\frac{1}{4}$ to $\frac{1}{2}$ Montgomery and $\frac{3}{4}$ to $\frac{1}{2}$ Friesian gives best results, this follows the previous results of published work at Pusa, India. It is considered that cattle having the above admixture of European and Indian blood would make excellent foundation stock for the establishment of a new breed.

The necessity for adequate feeding of stock is emphasised and it is considered that some of the so-called degenerate changes taking place may be in part due to the inadequate feeding of young animals. This applies in particular to European and European cross-bred stock in the tropics. The writer stresses the desirability of adding proteins to the ordinary grazing diet if well proportioned animals are to be grown. It is also considered that delaying the time of the calving of heifers of the larger European breeds permits them to develop into better animals.

The writer appears optimistic in suggesting that one prime objective should be the selection of Zebu bulls bred from cows that will let down their milk without the calf being present; the objective is an excellent one but the experience at Serdang is that the maternal instinct is so strong in these animals that it is essential with all our pure-bred Indian cows to have the calf present, at least at the commencement of milking, otherwise the cow will go dry in a very short time despite the efforts of the best milkers.

The published results in this bulletin show that a certain amount of success has been obtained at Trinidad in this respect. It is suggested that this characteristic may be an inherited one in Trinidad cows and is the result of an earlier infusion of European blood, in view of the statements that frequent importations of European stock of many breeds have been made for many decades past.

For successful dairying it is essential that cows shall permit of their calf being weaned at birth, and this is a strong argument in favour of the use of European breeds for the upgrading of tropical stock as milkers and to introduce docility as characterised in this form.

(T. D. M.)

Abstract.

FOURTEENTH REPORT ON NATIVE CULTIVATION.

First Quarter 1933.

*Prepared by the Bureau of Agricultural Economics of the Division
of Agriculture of the Netherland Indian Department of Agriculture
Industry and Commerce, at Buitenzorg, Java.*

General review.

In the previous report concerning the native rubber cultivation it was pointed out in passing that during the last months of 1932, quotations on the Batavia rubber market were stabilized at a level of from 7½ to 8 florin cents per ½ kilogram Java-Standard-Sheet. It was also reported that this price level continued over into January, 1933, and that only during the middle of the month, because Japan left the market, did a drop in prices occur. Within several days prices weakened to almost 6½ florin cents at which level — with the exception of the days just before the Chinese and Native holidays when prices momentarily rose to 7 florin cents — they stood during the entire month of February, with several minor fluctuations. Towards the end of February prices softened again to 6¼ florin cents. During the beginning of March the downward trend in prices was halted as a result of rumours indicating that the Netherland Government was willing to study anew the subject of rubber restriction. Prices at Batavia accordingly rose to 6½ florin cents.

Although the aforementioned rumours were found to be based upon an incorrect interpretation of an official statement, prices were maintained and this may be explained also by the general attitude of waiting existing on the produce markets as a result of the acute financial developments in the United States. During the rest of March the Batavia quotations for Java-Standard-sheet fluctuated about 6½ florin cents per ½ kilogram.

The export of native rubber from Netherland India reacted sharply to the lower prices. Although the monthly exports during the last quarter of 1932 averaged from between 6,500 to 7,000 metric tons of dry rubber, during January exports fell to 4,864 metric tons. In February to 4,102 metric tons and in March to 4,454 metric tons. Quarterly exports of native rubber in terms of dry rubber equivalents, were as follows during 1932 and during the first quarter of 1933 :—

First Quarter 1932	—	15,942 metric tons.
Second Quarter 1932	—	10,613 metric tons.
Third Quarter 1932	—	14,443 metric tons.
Fourth Quarter 1932	—	20,283 metric tons.
First Quarter 1933	—	13,420 metric tons.

A study of these figures with the trend in prices indicates just how sharply exports reacted to prices. Roughly speaking the price trend at Batavia per ½ kilogram of Java-Standard-sheet was as follows :—

First Quarter, 1932	—	Sharp price drop from 11 to 6½ florin cents;
Second Quarter 1932	—	Further price drop from 6½ to 5½ florin cents;
Third Quarter 1932	—	Marked price increase from 5½ florin cents to 10 and 11 florin cents in the beginning of September and then drop to 8½ florin cents;
Fourth Quarter 1932	—	Price stabilization at 8 to 7½ florin cents;
First Quarter 1933	—	Price drop in mid-January and stabilization at 6½ florin cents.

If we now inspect the quarterly production figures for the "Small-holders" in British Malaya, we find that this production group, much more than has previously been the case, also reacted to the trend in prices, although admittedly not as sharply as was the case of the native production in Netherland India. Production was as follows in metric tons:

First Quarter 1932	—	45,138 metric tons.
Second Quarter 1932	—	37,419 metric tons.
Third Quarter 1932	—	46,253 metric tons.
Fourth Quarter 1932	—	51,053 metric tons.
First Quarter 1933	—	44,445 metric tons.

Not only the native producers of rubber in various countries pay attention to the market quotations. Under the present conditions the estate producers also show a much greater tendency to follow the price trends than before.

In Sumatra and in British Malaya this tendency is not shown very clearly due to the conditions affecting the labour supply but in Java, where conditions affecting labour are much more favourable, this tendency comes to the fore, as expressed, among other things, by the figures showing the areas not tapped by estates in Java. At the end of February, 1932, these areas totalled 21,546 hectares; they then increased steadily and by the end of August reached a high peak of 72,415 hectares: after August many plantings were again taken into tap, the areas out of tap being reduced regularly to total 29,344 hectares by the end of February, 1933.

The following are among the interesting points abstracted from reports from the various producing areas:

Acheen and Dependencies. The export of native rubber which in the previous quarter showed an increase by 36 metric tons of dry rubber equivalent, fell, largely because of the lower prices, to 12 metric tons of dry rubber. Exports during January totalled 5 metric tons; during February they totalled 4 metric tons and during March 3 metric tons.

Tapanoeli. The export from Sibolga during the first quarter of 1933 totalled 57 metric tons (dry) of sheets: about one metric ton of wet rubber was exported out of Tapanoeli overland through Sumatra East Coast. A remilling factory during the period under review worked about 70 metric tons. The prices, which during the first half of January still averaged about 8 florin cents, weakened continually and reached a low point of 5 florin cents on March 20. Thereafter business was done at 6 florin cents. Exploitation of the gardens was almost entirely stopped.

Sumatra West Coast. The export from the ports of the Sumatra West Coast Province totalled only one metric ton of dry rubber equivalent while shipments out of the province overland through Djambi totalled 131 metric tons of wet rubber and through Sumatra East Coast 126 metric tons of wet rubber.*

Of the 1933 first quarter exports, no reference is made to the rubber which came out of the Loboek Sikaping and the Ophir districts. Tapping activities were curtailed in sympathy with the lower prices. These averaged about Fl. 2.40 at Soengai Dareh and Kota Baroe; from Fl. 1.60 to Fl. 1.30 at Bangkinang, prices being for 100 kilograms. Exploitation was largely done by means of family labour, while the tapping was done by boys from 13 to 17 years of age. Rubber is still of very small significance in the native economic scheme of things. It is even reported that in Bangkinang, near Kampar, about 50 hectares of rubber were cut down and the land planted with rice.

Palembang. The export of native rubber during the first quarter of 1933 included 3 metric tons of scraps and lumps and 1,303 metric tons of slabs, these figures being figures representing the dry weight equivalent. Tapping was carried on, among other places, in the L V Petoelai "margas" ("margas" equivalent to collection of villages), principally just before the rice harvest since the owners of the rubber gardens needed money to buy rice, and also a little bit in other "margas", for instance, in Lengi in Lematang Ilir in Tanjong Batoe and Moeara Koeang in Ogan Ilir in Moesi Ilir and in Moesi Oeloe.

Western Division of Borneo. The total export, expressed in terms of dry rubber equivalent amounted to 4,048 metric tons, which is about 180 metric tons more than was exported during the first quarter of 1932. Compared with the previous quarter, there is a decline in export of 784 metric tons which may be explained by the falling prices and by the fact that labour was required to work the food crops and was thus not available for tapping, the latter being stopped entirely even in the Sub-district of Upper Kapoeas.

* In the Thirteenth Report the exports for the above exports during the fourth Quarter of 1932 were incorrectly given as 19.9 metric tons through Djambi and 18.8 metric tons through Sumatra East Coast. These exports were actually 199 and 188 metric tons respectively.

Wherever great scarcity of money was the rule, it was by no means uncommon for the adults to bring in the rice crop, while the children were sent out to tap.

Southern and Eastern Division of Borneo. The export, calculated in terms of dry rubber equivalent, fell from 3,733 metric tons during the fourth quarter of 1932 to 1,764 metric tons, which amount is just about equal to exports made during the second quarter of 1932. The formation of stocks did not generally take place so that the 1933 first quarter export gives a fair idea as to the amount of tapping done during that period. The cutting down of rubber trees for the purpose of using the ground for growing food crops took place on a limited scale in the hill and mountain country about Barabai.

Riouw and Dependencies. (Fourth Quarter 1932).

On the mainland (of Sumatra), the rubber gardens are found primarily in the upland areas and in the lowland areas the rubber cultivation is generally not of much importance to the population. The total export from these upland areas amounted to 1,251 metric tons (dry rubber equivalent) while the export from the islands of Riouw and Dependencies totalled 359.7 metric tons of wet rubber, which having a moisture content of 15%, gives a dry rubber total of 306 metric tons.

Departmental.

FROM THE DISTRICTS.

The Weather.

As usual June was a fairly dry month throughout the country. The rainfall returns indicate that little departure from normal was experienced in this respect anywhere. In many cases the precipitation figures were the result of a few heavy showers with long dry periods between. Malacca was the only place where the rainfall shows any appreciable departure from normal, being somewhat higher than is usual for the month. In Kelantan the month was wetter than during May.

Remarks on Crops

Rubber. The highest and lowest prices in dollars and cents per pikul recorded during the month in returns from a large number of centres throughout the country were—Smoked Sheet \$10.00 to \$15.25; Unsmoked Sheet \$6.30 to \$14.00; Scrap \$2.00 to \$6.00. The average Singapore price recorded for small-holders' rubber is—Smoked Sheet \$13.50; Unsmoked Sheet \$12.25 and Scrap \$5.00 whilst Penang prices for Unsmoked Sheet ranged from \$11.20 to \$14.00 and for Scrap from \$4.20 to \$6.60.

Reports indicate that the further increase in price of the commodity has resulted in still further holdings being brought into tapping. Judging from roadside counts it would appear that in some areas, such as parts of Perak and Negri Sembilan, some 90 per cent. of the holdings are now in tapping. On the other hand, the Selangor report indicates that in some districts of that State many small-holders appear to be doubtful whether the price will be maintained and are at present unwilling to incur the expense of opening up rested holdings.

Padi. The price of padi at the Government Rice Mill at Bagan Serai still remains at \$1.60 a pikul. It is reported that the Kedah price has shown a further slight increase.

Preliminary cultivation in preparation for the new padi season is reported from Kedah and from Province Wellesley, and the sowing of nurseries has commenced in parts of Krian and in North Perak generally. Similar activities are reported from Malacca, whilst transplanting is taking place in Negri Sembilan and the riverine mukims of Pahang. In Selangor, the short season crop, in areas where double cropping is being practised, is reported to be making good progress.

Coconuts and copra. Further sales of copra from approved kilns are reported from both the South and Central districts of Province Wellesley, and the possibilities of co-operative copra marketing were discussed at a District Economic Board Meeting held in that Settlement. In the Bagan Datoh area, the erection of improved kilns has made a little further progress. In Selangor,

further kilns have been erected in Kuala Langat district and the quality of the copra produced has shown a marked improvement, chiefly because the two main buyers operating refuse to accept anything but well prepared and satisfactorily dried copra. A high grade product continues to be turned out by the five 'kongsi' kilns in the Kuala Selangor district and the three in Sabak Bernam. The Sabak Bernam kilns are sending their product direct to Penang. The Malay officer who has been trained as a Copra Instructor was transferred to Temerloh at the end of the month in order to instruct a number of Malays in the proper methods of copra production. The small-holders concerned have erected a well designed clay-walled kiln on the banks of the Pahang river and, if the venture proves a success, it is likely that others will follow their example. Satisfactory arrangements have been made to despatch the copra made direct to Singapore for sale.

Coffee. Further details are to hand this month regarding the preparation by Malay small-holders of coffee in Kuala Langat district of Selangor. There are now eight Malay-run manufacturing centres scattered through the coffee growing areas; the average output from these is approximately 70 pikuls of prepared beans per month.

Tobacco. The Kedah report records that an area of about 70 acres is under this crop in that State. In Province Wellesley approximately 75 pikuls of cured leaf was sold, the price ranging between \$29 and \$42 per pikul according to quality. The interest in this crop is reported to be maintained in South Perak.

Agricultural Stations.

Towards the end of the month the Chief Field Officer visited the Pahang Agricultural Stations at Kuala Lipis and Temerloh. Records of distribution from Kuala Lipis station indicate that there is a distinct need for Agricultural Stations in Pahang to supply planting material. Reports indicate that the permanent crops of Selama station are now making satisfactory progress after a very slow start. At this station successful budding of Java clones of Kapok have been carried out. Similar satisfactory progress is reported from most of the other stations.

Padi Experiment Stations and Test Plots.

Renewed activity in preparation for the coming crop is reported from all parts of the country, and on most padi stations nurseries have been prepared and sown. At Bukit Merah, in Province Wellesley, experimental trials with mushrooms are meeting with a certain amount of success.

DEPARTMENTAL NOTES.

Visits and Tours.

The Chief Research Officer visited Province Wellesley and Negri Sembilan during May 1933 in connection with soil and manurial problems relating to coconut palms.

The Acting Agricultural Chemist, Major C. D. V. Georgi, O.B.E., visited Singapore on May 1st. in connection with matters relating to palm oil, jelutong and tuba root.

School of Agriculture, Malaya.

Forty seven students were in residence at the School at the end of May and three more will arrive at the end of June or early in July. Two of the students have been selected from candidates for the two scholarships created by the Jaffnese Co-operative Society Ltd. The enrolment of private students for the present School year has been satisfactory.

The two Brunei and two Kelantan pupils, who completed the one year course last April, have been given special instruction in copra production at Klang etc., by arrangement with the Agricultural Field Officer, during the first half of May. The Kelantan boys then spent a week in Malacca gaining experience on Agricultural Stations, under the Agricultural Field Officer, and have since returned to Kelantan, while the Brunei boys spent a fortnight at Kuala Kangsar, to gain experience in poultry, and will spend the next two months at Malacca.

A party of boys from the Methodist Boys' School, Kuala Lumpur, was conducted round the School on 24th May.

The Rural Lecture Caravan.

The Rural Lecture Caravan toured Negri Sembilan during April and the first week in May 1933.

The Caravan then proceeded to Province Wellesley and toured the State during May and the first week of June 1933.

Award of the Certificate of Honour to Enche Abdul Jalil bin Haji Hassan.

In the name of His Majesty the King, His Excellency the High Commissioner has been pleased to award the Certificate of Honour to Enche Abdul Jalil bin Haji Hassan formerly Malay Agricultural Subordinate, Grade I, in the Department of Agriculture, S.S. and F.M.S.

Visitor to the Department.

Prof. F. L. Engledow, M.A., paid a visit to the Headquarters of the Department of Agriculture, Kuala Lumpur, on June 23rd, 1933, and inspected the laboratories and discussed matters relating to agricultural problems with the Director and the Senior Staff.

Prof. Engledow accompanied by the Agriculturist, Mr. Bunting, visited the Government Experimental Plantation, Serdang, during the afternoon of June 23rd, and inspected the School of Agriculture, the Dairy Farm and the experimental work on crops in progress on the plantation.

Leave and Staff Changes.

Mr. H. D. Meads, formerly Assistant to Statistician, has been appointed Personal Assistant to the Director of Agriculture, S.S. and F.M.S., with effect from June 6th 1933.

Mr. W. G. Higgins has been appointed to succeed Mr. Meads as Assistant to Statistician with effect from June 6th 1933.

Mr. W. N. C. Belgrave, Chief Research Officer, has been granted full pay leave of 10 months from 15th June 1933 to 14th April, 1934.

Mr. G. H. Corbett, Government Entomologist has been granted full pay leave of 9 months and 11 days from 23rd. June, 1933 to 2nd April 1934.

CERTIFICATE OF HONOUR TO INCHE ABDUL JALIL BIN HAJI HASSAN.

It is a pleasure to record in this Journal that Inche Abdul Jalil bin Haji Hassan was selected for the award of a Certificate of Honour on the occasion of the birthday of His Majesty the King on June 3rd, 1933.

Inche Jalil was born at Alor Gajah in 1876 and entered the service of Government as Malay Assistant to the District Officer, Kuala Pilah, on February 6th, 1903. He joined the Department of Agriculture as Sub-Inspector of Coconuts on March 1st, 1907 and retired from the Department's service as as Malay Agricultural Subordinate, Grade 1, on January 1st, 1933. Thus he spent 30 years in Government service, 26 years being in the service of the Department of Agriculture.

It is on record that early in his service he gained the reputation of being an officer who could be relied upon to spare no effort to carry out any work assigned him to the best of his ability, and this reputation he has retained throughout his service.

Inche Jalil rendered specially creditable assistance to this Department on several occasions. In 1914—15 he was of particular value in tracing and reporting swarms of locusts and organising Malay gangs to deal with them. Similarly, in the 1924—25 padi season his recognised persuasive powers and influence with the small-holders, and with the headmen, in Kuala Pilah district was an important factor in the successful organisation of gangs to deal with the *Leptocorisa* (Pianggang) pest of padi which threatened the spoilation of the crop. Of more recent years he has, by precept and example, encouraged the planting of high yielding pure strains of padi in Kuala Pilah district with success.

For the past twelve years Inche Jalil has served under Mr. Barnes, Acting Agricultural Field Officer, Negri Sembilan, who speaks highly of Inche Jalil's reliability, intimate knowledge of his district and ability to work in close co-operation with the small-holders and headmen with whom he came in contact. three important attributes in the case of an Agricultural Officer.

Statistical.

MARKET PRICES

May 1933.

Rubber.—The market price for rubber has been fairly steady during the month, opening at 11½ cents per lb. for Spot loose in Singapore and closing at 11½. The average price for the month was 10 15/16 cents per lb. in Singapore 3½ pence in London and 6 cents Gold in New York, as compared with 9.08 cents, 2.87 pence and 4.8 cents Gold respectively in May.

Palm Oil.—The course of the English market during June on a basis of 18 per cent. f.f.a., c.i.f. Liverpool was as follows:—

June 1st £18 per ton market steady; 7th £18; 14th £18; 21st £17 market quiet; 28th £17.10 market steady. Prices in the U.S.A. landed weight per pound in bulk c.i.f. New York/Philadelphia were 3.40 cents Gold on the 14th and 3.25 cents Gold on the 26th.

The price of palm kernels Fair Average Malayan Quality c.i.f. landed weight on the Continent fell from Shillings 9/7½ per cwt. on the 1st to Shillings 8/9 per cwt. on the 21st.

Copra.—There was a steady fall in the price from the 12th. The highest Singapore price for Sundried during June was \$4.40 per picul on the 7th., the average price being \$4.13 per picul as compared with \$3.96 during May. The mixed quality averaged \$3.74 per picul as compared with \$3.70 per picul in May.

Coffee.—During the month the price at Singapore for Sourabaya coffee increased slightly, ranging according to grade from \$21.50 to \$24 as compared with \$20 to \$22.50 during May. Palembang coffee averaged \$13.90 during the month having dropped from \$15 on the 1st to \$13 on the 29th. The average figure for May was \$16.87.

Arccanuts.—Palembangs averaged \$2.33 and Bila Whole \$2.66 per picul as compared with \$2.61 and \$2.86 respectively during May. The range of Singapore prices for other grades were:—Split \$3.25 to \$5.25, Red Whole \$4.50 to \$5.50 Sliced \$7 to \$8, Kelantan \$4.30 to \$4.50.

Gambier.—Block Gambier declined in price towards the end of the month, the average price being \$4.64 per picul, cube average \$7.40. Corresponding figures for May were \$3.94 and \$7.50 per picul respectively.

Pineapples.—Values firmed somewhat during June the average Singapore per case being Cubes \$3.09, Sliced Flat \$3.00, Sliced Talll \$3.22, as compared with \$2.85, \$2.75 and \$2.29 respectively during May.

Tapioca.—The price of Flake average \$4.12 as compared with \$4.36 in May. Pearl Seed averaged \$5.37 as compared with \$5.06 in May and Pearl Medium average \$5.62 as compared with \$5.31 in the previous month.

Sago.—Pearl Seed Fair remained steady at \$4.75 as compared with \$4.40. Flour Sarawak Fair averaged \$1.90 as compared with \$1.85 in May.

Mace.—Average prices were \$65 per picul for Siouw and \$45 for Amboina, a considerable increase from prices ruling during May which were \$60.50 and \$38 respectively.

Nutmegs.—Prices increased from the ruling figures for May. Singapore price per picul for 110's was \$22.75 as compared with \$18.12 in May. 80's increased to \$31.50 having remained steady at \$24.25 in the previous month.

Pepper.—Average Singapore prices during June were as follows:—Singapore Black \$17.75 per picul, Singapore White \$29 and Muntok White \$29.75, the corresponding prices for May were \$15.25, \$24.87 and \$26.62 respectively.

Cloves.—As in May there has been small demand for cloves, nominal prices being \$40 for Zanzibar and \$45 per picul for Amboina.

GENERAL RICE SUMMARY.

May 1933

Malaya.—Gross foreign imports of rice (including stocks available for re-export) during May 1933, amounted to 49,838 tons, as compared with 38,225 tons in May 1932, of which 51 per cent. were consigned to Singapore, 20 per cent. to Penang, 7 per cent to Malacca, 18 per cent. to the Federated Malay States and 4 per cent to the Unfederated Malay States.

Of these imports, 59 per cent. were from Siam, 37 per cent from Burma, 2 per cent. from Indo-China and 2 per cent. from other countries.

Total foreign exports of rice from Malaya in May 1933, were 11,440 tons (including 391 tons local production) as compared with 12,557 tons in May 1932.

Of these exports 82 per cent. were consigned to Netherlands India and 18 per cent. to other countries.

Net imports for the period January to May 1933, were 169,081 tons as compared with 165,207 tons during the same period for 1932, an increase of 2 per cent

India and Burma.—Total foreign exports of rice during April 1933, were 205,000 tons as compared with 277,000 tons in the previous month and 231 tons in April 1932.

Total exports of rice and bran from Burma during the period January 1st to April 29th amounted to 1,192,866 tons as compared with 1,374,727 tons for the corresponding period in 1932, a decrease of 13.2 per cent.

Siam.—Exports (approximate) during May 1933, amounted to 127,356 tons as compared with 123,458 tons in May 1932.

Netherlands India, Java and Madura.—At the end of April 1933, the area harvested amounted to 2,651,000 acres a decrease of 13,000 acres or 1 per cent. as compared with the corresponding period of 1932: the area damaged was 79,000 acres a decrease of 4,000 acres or 5. per cent. as compared with 1932, and additional plantings awaiting harvesting amounted to 5,787,000 acres an increase of 154,000 acres or 3 per cent.

French Indo-China.—Entries of padi at the port of Cholon from January to May 1933, amounted to 559,265 (metric tons, an increase of 9,173 tons or 2 per cent. as compared with the same period of 1932.

Exports of rice from Saigon for the period January to May 1933, totalled 652,116 tons, an increase of 118,944 tons or 22 per cent. as compared with the corresponding period of 1932.

~~Of these imports 21 per cent. were from British India, 72 per cent. from Burma, and 7 per cent. from other countries.~~

Europe and America.—Quantities of rice shipped from the East were :—

- (a) To Europe for the period January 1st to May 25th, 640,554 tons, a rise of 189,771 tons or 42 per cent. as compared with the same period of 1932. Of these shipments 50 per cent. were from Burma, nil from Japan, 39 per cent. from Saigon, 6 per cent. from Siam and 1 per cent. from Bengal as compared with 61 per cent. from Burma, nil from Japan, 32 per cent. from Saigon, 2 per cent. from Siam and 5 per cent. from Bengal in 1932.
 - (b) To the Levant, period January 1st to April 12th, 15,156 tons, a fall of 17,580 tons or 54 per cent. as compared with the same period of 1932.
 - (c) To America and the West Indies for the period January 1st to April 27th 1933, 41,492 tons a decrease of 12,517 tons or 23 per cent. as compared with the same period of 1932.
-

MALAYA RUBBER STATISTICS

ACREAGES OF TAPPABLE RUBBER NOT TAPPED ON ESTATES OF 100 ACRES AND OVER, FOR THE MONTH ENDING MAY, 1933.

STATE OR TERRITORY	Acreage of Tappable Rubber end 1932	ESTATES WHICH HAVE ENTIRELY CEASED TAPPING		ESTATES WHICH HAVE PARTLY CEASED TAPPING		Total (3) + (5)	Percentage of (7) to (2)
		Acreage (3)	Percentage of (3) to (2) (4)	Acreage (5)	Percentage of (5) to (2) (6)		
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
STRAITS SETTLEMENTS :—							
Province Wellesley	44,734	2,018	4.5	8,516	19.0	10,534	23.5
Dindings	6,969	404	5.8	927	13.3	1,331	19.1
Malacca	111,780	5,540	5.0	20,834	18.6	26,374	23.6
Penang Island	1,635	977	59.7	52	3.2	1,029	62.9
Singapore Island	28,269	11,580	41.0	4,657	16.5	16,237	57.4
Total S.S.	193,387	20,519	10.6	34,986	18.1	55,505	28.7
FEDERATED MALAY STATES :—							
Perak	250,951	11,749	4.7	34,990	13.9	46,739	18.6
Selangor	308,379	19,749	6.4	40,922	13.3	60,671	19.7
Negeri Sembilan	228,541	16,214	7.1	20,131	8.8	36,345	15.9
Pahang	38,141	8,928	23.4	4,802	12.6	13,730	36.0
Total F.M.S.	826,012	56,640	6.9	100,845	12.2	157,485	19.1
UNFEDERATED MALAY STATES :—							
Johore	325,747	41,169	12.6	31,820	9.8	72,989	22.4
Kedah (a)	114,551	8,909	7.8	6,985	6.1	15,894	13.9
Kelantan	21,175	8,126	38.4	1,985	9.4	10,111	47.8
Trengganu (b)	4,352	Nil	Nil	2,072	47.6	2,072	47.6
Perlis (a)	957	106	11.1	502	52.5	608	63.5
Total U.M.S.	466,782	58,310	12.5	43,304	9.3	101,674	21.8
Total MALAYA	1,486,181	135,469	9.1	179,195	12.1	314,664	21.2

Notes :— (a) Registered companies only and are rendered quarterly.

(b) Registered companies only.

The above table together with a Summary, was prepared and published by the Statistics Department, S.S. and F.M.S. in June 1933.

MALAYAN AGRICULTURAL EXPORTS, MAY, 1933.

PRODUCT.	Net Export in Tons.				
	Year 1932	Jan.-May 1932	Jan.-May 1933	May 1932	May 1933
Arecanuts ...	20,280	10,620	9,185	1,522	1,236
Coconuts, fresh ...	108,123†	40,134	37,665	6,966	7,013
Coconut Oil ...	11,932	4,262	7,907	763	1,595
Copra ...	97,464	28,568	35,751	1,542	6,591
Gambier, all kinds ...	2,925	1,278	1,040	262	291
Palm kernels ...	1,248	486	612	186	194
Palm oil ...	7,892	2,751	3,753	824	1,452
Pineapples, canned ...	66,291	31,065	24,577	8,522	6,942
Rubber § ...	417,137	150,342	149,653	30,234	33,461
Sago,—flour ...	10,267	4,116	1,836	337*	307
" —pearl ...	3,128	1,126	886	273	221
" —raw ...	4,148*	1,461*	1,644*	188*	271*
Tapioca,—flake ...	9,028	3,926	5,112	834	977
" —flour ...	392	76*	181*	32	137*
" —pearl ...	19,977	8,484	6,952	1,899	1,352
Tuba root ...	165‡	49‡	182	8	56

† hundred in number.

§ production.

* net imports.

ACREAGES OF TAPPABLE RUBBER OUT OF TAPPING IN
NETHERLANDS INDIA, AT END FEBRUARY, 1933.

	A Totally Ceased.		B Partly Ceased.		Total A & B	
	Estates	Area in acres	Estates	Area in acres	Estates	Area in acres
Java and Madura ...	135	55,000	66	17,480	201	72,480
Outer Provinces ...	198	70,296	70	40,315	268	110,611
Netherlands India ...	333	125,296	136	57,795	469	183,091

The total area out of tapping for February amounts to 18.8 per cent. of the total tappable area at end of December, 1932.

(Authority : Economisch Weekblad, page 1801, dated 28th April, 1933).

TABLE I
MALAYA RUBBER STATISTICS
STOCKS, PRODUCTION, IMPORTS AND EXPORTS OF RUBBER, INCLUDING LATEX, CONCENTRATED LATEX AND REVERSEX,
FOR THE MONTH OF MAY, 1933 IN DRY TONS.

Territory	Stocks at beginning of month 1		Production by Estates of less than 100 acres estimated 2		Imports		Exports including re-exports during the month		Stocks at end of month	
	Dealers	Estates of 100 acres and over	January to May 1933	January to May 1933	From Foreign	From Malay States	Foreign	Local	Foreign	Local
MALAY STATES :-										
Federated Malay States	2	3	4	5	6	7	8	9	10	11
Johore
Kedah
Perlis
Kelantan
Trengganu
Total Malay States
STRAITS SETTLEMENTS :-										
Malacca
Province Wellesley
Dindings
Penang
Singapore
Total Straits Settlements
TOTAL MALAYA

TABLE II
DEALERS' STOCKS IN DRY TONS 3

Class of Rubber	Federated Malay States		Penang		S. Pore		Pore-Ince		Johore		Total
	20	21	22	23	24	25	26	27	28	29	
DRY RUBBER	9,556	20,635	3,432	4,749	1,028	138	357	1,792	320	495	
WET RUBBER	8,178	8,919	508	140	1,792	357	1,792	320	495		
TOTAL	12,734	24,354	3,940	4,889	3,220	495					

TABLE III
FOREIGN EXPORTS

PORTS	For month	
	January to April inc.	January to April inc.
Singapore	26,970	119,634
Penang	...	8,431
Port Swettenham	...	6,437
Malacca	...	1,010
MALAYA	...	42,848

TABLE IV
DOMESTIC EXPORTS 4

AREA	For month	
	January to April inc.	January to April inc.
Malay States	...	34,534
Straits Settlements	...	173,398
MALAYA	...	34,534

Notes.—1. Stocks on estates of less than 100 acres and stocks in transit on rail, road or local steamer are not ascertained.

2. The production of estates of less than 100 acres is estimated from the formula: Production + Imports + Stocks at beginning of month = Exports + Stocks at end of month. + Consumption. i.e., Column [7] = Column [13] + [14] + [17] + [18] + [19] + 14 tons local consumption during the month — [2] — [3] — [4] — [5] — [9] — [10]. For the Straits Settlements, Columns [7] and [8] represent purchases by dealers from local estates of less than 100 acres, reduced by 15% to terms of dry rubber.

3. Dealers' stocks are estimated by deducting the average monthly dry rubber exports from the average monthly dry rubber production of the Federated Malay States and the Straits Settlements.

4. Domestic exports are estimated by deducting the average monthly dry rubber exports from the average monthly dry rubber production of the Federated Malay States and the Straits Settlements.

5. The above, with certain omissions, is the Report published by the Registrar-General of Statistics, S.S. and F.M.S., at Singapore on 22nd June 1933.

METEOROLOGICAL SUMMARY, MALAYA, MAY, 1933.

LOCALITY	AIR TEMPERATURE IN DEGREES FAHRENHEIT				EARTH TEMPERATURE		RAINFALL						BRIGHT SUNSHINE							
	Means of				Absolute Extremes		At 1 foot		At 4 feet		Total		Most in a day		Number of days			Total	Daily Mean	Per cent
	A.	B.	Min.	Mean of A and B	High	Low	High	Low	High	Low	in.	mm.	Amt.	Precipitation .01 in or more	Precipitation .05 in or more	Thunder-storm	Fog morning obs.				Gale force 8 or more
					est	est	est	est	est	est								est	est	est
Railway Hill, Kuala Lumpur, Selangor	91.2	73.3	82.3	94	71	86	75	13.03	353.8	2.25	24	22	15	6	187.95	6.06	49			
Bukit Jeram, Selangor	88.4	73.5	80.9	92	71	84	75	3.20	81.3	0.98	12	8	4		224.75	7.25	59			
Sitiawan, Perak	91.3	73.9	82.6	96	72	85	78	3.47	88.1	1.77	15	12	5	2	221.65	7.15	58			
Kroh, Perak	88.9	70.8	79.9	93	64	85	73	10.55	268.0	3.16	18	16	2	5	229.20	7.39	60			
Temerloh, Pahang	91.0	73.8	82.4	93	71	89	76	13.20	335.3	3.94	18	14	3		224.90	7.25	59			
Kuala Lipis, Pahang	89.8	72.4	81.1	92	70	88	75	12.08	306.8	3.44	21	17	2	17	206.15	6.65	54			
Kuala Pahang, Pahang	87.7	74.5	81.1	91	72	86	77	4.01	101.9	1.21	15	11	1		234.85	7.58	61			
Mount Faber, Singapore	88.7	75.3	82.0	93	72	83	80	6.29	159.8	1.87	14	10	6		189.80	6.12	50			
Butterworth, Province Wellesley	89.5	75.1	82.3	92	73	88	77	7.58	192.5	2.62	14	10	2	1	258.80	8.35	68			
Bukit China, Malacca	86.2	74.5	80.3	92	72	82	77	3.60	91.5	0.64	14	10	4		200.75	6.48	53			
Kluang, Johore	89.3	72.3	80.8	93	70	85	75	8.78	223.0	1.58	21	19	7	18	204.25	6.59	54			
Bukit Lalang, Mersing, Johore	88.7	72.9	80.8	91	71	85	75	5.60	142.3	3.22	14	10	1	1	244.60	7.89	66			
Alor Star, Kedah	90.3	74.7	82.5	94	72	87	77	5.87	149.1	1.25	18	16	9		255.70	8.25	67			
Kota Bharu, Kelantan	90.4	74.7	82.5	94	73	86	76	0.46	11.7	0.20	9	3			260.90	8.42	65			
Kuala Trengganu, Trengganu	89.2	73.8	81.5	92	72	86	76	4.39	111.5	1.74	10	7	1	2	248.20	8.01	65			
HILL STATIONS.																				
Fraser's Hill, Pahang 4268 ft.	75.2	64.0	69.6	80	62	72	66	16.21	411.7	4.27	26	21	2	7	149.60	4.83	39			
Pahang Cameron Highlands, Tanah Rata, Pahang 4750 ft.	74.3	57.9	66.1	78	52	71	62	13.74	349.0	2.29	23	21	13	1	166.00	5.35	43			
Cameron Highlands, Rhododendron Hill, Pahang 5120 ft.	73.3	60.5	66.9	78	59	69	62	14.34	364.3	1.88	23	20		1	175.65	5.67	46			

Compiled from Returns supplied by the Meteorological Branch, Malaya.

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THE Malayan Agricultural Journal.

AUGUST, 1933.

EDITORIAL.

Malayan Soils.

The present number of the *Malayan Agricultural Journal* contains an article dealing with Malayan soil types, by Mr. J. H. Dennett, of the Soils Division of the Department of Agriculture, S.S. and F.M.S. This paper is the first of a series of four which it is proposed to publish in this Journal under the general title of "Studies in Malayan soils". The paper is prefaced by a general introduction to the series by the Director of Agriculture in which certain modern views on soil science and their application to Malayan conditions are set out.

These papers will give an account, so far as possible in non-technical language, of some of the important factors governing soil fertility under the conditions obtaining in Malaya, and of the results of certain researches on the question which have been undertaken during the past three years.

Padi Stem Borers.

Un common with other agricultural crops padi is attacked by numerous pests, amongst the most important of which, in certain areas in Malaya, are moths whose larvae bore into the stems of padi plants and cause considerable loss by interfering with the production of grain.

Reports are received every season from the rice growing districts of this country of damage caused by stem-borers to the crop, and it is evident that the insects are responsible for appreciable damage and reduction in yield in certain areas.

The most important of these stem-borers in Malaya, are insects belonging to the three genera *Diatraea*, *Schoenobius* and *Sesamia*. For some years experiments aiming at control of these pests have been in progress in Krian, in the hope that a method of dealing with the outbreaks may be evolved which will lead to increased production of rice as a result of minimising the losses directly due to stem-borer attack.

The article contributed to the present number of the *Malayan Agricultural Journal* is a record of experimental work in this connection, in Krian during the 1931-1932 Padi season.

The insects mainly responsible for the damage are difficult to control by the ordinary measures usually adopted against pests, particularly since the whole of their larval stage is spent inside the stem of the attacked plant and they are thereby protected.

Another species of stem-borer—*Scirpophaga*—is controlled in Java by flooding and by crop rotation, but, in Malaya, the species of stem-borer mentioned above are not to any extent affected by flooding, and rotation of crops is not extensively practiced. In former experiments, the results of collection of moths attracted by light traps were not very encouraging, and it was considered that the most promising line of attack would probably be the adoption of some form of biological control.

The practice of this method of control originated from the fact that many injurious insects can be parasitised at some stage of their life history by other species, and that many injurious plants are attacked by insect enemies. The importation of an insect pest or an injurious plant into a country where its natural enemies do not exist may have serious consequences, and, of recent years, the practice of importing the known natural enemies of an insect or plant has come into prominence.

As instances of the value of the method, the beneficial effect of the importation of *Ptychomyia remota* into Fiji from Malaya for the control of the coconut leaf eating caterpillar—*Levuana iridescens*—and of the importation of a moth—*Cactoblastis*—into Australia for the control of the prickly pear may be mentioned.

Several local parasites of Malayan padi stem-borers have been studied, and the article now published contains the results obtained in the experiments with a parasite of the eggs of stem borers.

The parasite—*Trichogramma minutum*—attacks the eggs of *Diatrea* and to a certain extent those of *Schoenobius*, and was chosen for trial in the Krian area, where experimental liberation was made on a number of selected sites as detailed in the article.

The investigation has shown that *Trichogramma* is not an effective parasite of padi stem-borer eggs even when the total rate of liberation was 1,300,000 parasites per acre.

It is evident therefore that further work will be required before efficient measures for the control of stem-borers can be recommended.]

Padi Sawahs as Pasture Land. The establishment of agricultural services in Kedah, by the appointment of a Principal and of an Assistant Agricultural Officer, has made it possible to obtain information concerning many agricultural matters in this territory. Situated as it is in the north of the Peninsula where the climate is somewhat different to that of the F.M.S., and where there is a large Malay population engaged in rice cultivation, Kedah presents certain problems different to those obtaining in the more southerly States and opens up a new field of enquiry into established practice in rice cultivation, in an area where rice has been grown on a large scale for many years.

The article published in the present issue of this Journal, is a contribution from Mr. W. N. Sands, Principal Agricultural Officer, Kedah. It describes the natural vegetation of the rice lands in North Kedah in the period of the intercrop, and is a valuable ecological study of the flora in this region.

In the *Malayan Agricultural Journal* of June, 1932, reference was made to the cultivation of rice in Italy, where a system of alternation of rice growing with pasture land for grazing and with another crop such as wheat has been successfully adopted. In Kedah and in Kelantan where it is the practice to graze cattle on the sawah land, the prospects of adopting a somewhat similar type of rotation are considered worthy of investigation, and the account now published of the grasses and other forms of vegetation which normally appear in the sawahs in Kedah is of importance in this connection.

Reference is also made to the possibility of improving local pastures by selection of useful indigenous species of grasses and by introduction of exotic species. Some of the difficulties which may be expected to arise in attempting to establish pasture areas on padi sawahs are described, and it is pointed out that amelioration of soil conditions by the provision of effective drainage is of primary importance.

It should also be realised that if, in addition, the land is utilised for the cultivation of other food crops, during the period between harvesting and sowing, free grazing of cattle is not to be encouraged, and the provision of some form of fencing would appear to be essential, on areas intended for grazing. Controlled irrigation would naturally be of great assistance in the successful operation of any such scheme.

STUDIES IN MALAYAN SOILS.

Introduction.

BY

H. A. TEMPANY,

Director of Agriculture.

In this and in succeeding numbers of the *Malayan Agricultural Journal* will appear a series of four papers by members of the staff of the Soils Division of the Department of Agriculture under the general title of "Studies in Malayan Soils". The object of this series is to provide, so far as possible in non-technical language, a general account of some of the more important factors governing soil fertility under tropical conditions, and particularly under Malayan conditions, and of the results of certain researches thereon undertaken during the last three years.

In no direction have ideas moved more rapidly and undergone a greater change in orientation than in the case of soil science. The days are gone when it was supposed that all that was necessary to ascertain the manurial requirements of a crop was to perform an analysis of the soil with the object of finding out what, if any, manurial constituents were deficient and then to supply the deficiency by means of dressings of fertilisers.

At the present time *the outstanding fact is that the best index to the condition of the soil and its requirements and deficiencies is the behaviour of the growing plant*, and more and more have soil scientists come to rely upon the plant as the most reliable source of information. The modern tendency is to note the behaviour of plants under varying methods of treatment, when grown under controlled conditions on particular soils, and then to endeavour to correlate the information so obtained with the observed chemical, physical and biological properties of the soil itself.

These four papers will illustrate this method of approach and the type of information which can be obtained from it.

In so far as Malayan soils are concerned, there is a popular belief that they naturally represent soil types of almost inexhaustible fertility and this belief is apparently supported by the fact that in few if any countries, which have attained a similar stage of development, has the use of fertilisers and manures become less generalised.

It is further apparently supported by the luxuriant clothing of tropical vegetation which originally covered the country from one end to the other and of which vast areas still remain untouched, and by the fact that rubber, the principal crop will, under the majority of conditions, go on giving satis-

factory yields for long periods without manurial applications while similar remarks apparently apply, in many cases, to the crops which occupy the second and third largest areas, namely rice and coconuts.

In point of fact this assumption of great fertility is a fallacy. Malayan soils are normally of considerable age and are distinctly deficient in plant food constituents. Under the climatic conditions prevailing in this country, they have been steadily leached of a large proportion of their fertilising constituents; consequently after they have been cleared they rapidly show signs of impoverishment with continued cultivation, particularly under annual crops. The fact that rubber rice and coconuts can be and are grown for long periods without fertilisers is in large part due to the fact that, apart from the material actually required for the building of the tree itself, the demands for plant food made by the rubber tree on the soil are almost negligible, while in so far as the other two crops are concerned they are practically entirely grown on alluvial soils which, being composed of transported material brought down from the higher lands, differ from the generality of soils in that, by their origin, they tend to be richer in plant food, and, being fine grained in texture, the plant food contained in them tends to be more readily available.

It is when we come to consider the cultivation of annual crops that the truth of this assertion is most plainly seen, and this is particularly well exemplified by the general attitude towards tapioca which is erroneously regarded as a dangerously exhausting crop, the cultivation of which should only be permitted under the most rigid restriction.

In point of fact tapioca is no more exhausting than many other annual crops; its reputation in Malaya is largely due to the fact that it has been extensively cultivated on naturally poor soils without any steps being taken to replenish the plant food removed.

The first paper in this series is a general one and deals with Malayan soil types, their mode of origin and general characters.

In the second paper, the question of measures necessary to the maintenance of fertility when annual crops are grown will be dealt with; apart from the question of the supply of plant food, the dependence of the soil on a continual supply of organic matter is emphasised. In many of the older tropical countries, especially those in which the area available for cultivation is geographically circumscribed, *e.g.* the West Indian Islands or Mauritius, where sugar cane is the principal crop, this problem has been solved by the utilisation of the excreta of the large number of farm animals employed for cultivation and haulage in crop operations, for the production of pen manure on a large scale. It is undoubtedly due to this practice that it has been possible to grow consecutive crops of sugar cane, on these lands, in some instances for close on two hundred years. When this provision is absent, as in Demerara, it has been found that, notwithstanding the extensive use of artificial fertilisers, non-productiveness is ultimately liable to ensue.

The maintenance of the supply of soil organic matter, quite as much as the maintenance of the supply of plant food, is therefore a key to success in agriculture in the tropics, and, in a country where industrial conditions do not call for the upkeep of large herds of cattle, the means of supplying organic matter to the soil is of very considerable importance.

To the solution of the problem the studies contained in the second paper of the series will constitute a contribution.

The third paper will deal with the relationships of organic matter and nitrogen in the soil, and will contain an account of investigations concerning the complex processes which obtain in this connection; these, it should be added, are definitely dissimilar in certain respects to those which obtain under temperate conditions.

The fourth paper will contain results of experiments on a field scale wherein certain of the points brought out in the previous papers are tested and demonstrated.

The soil represents the most valuable natural resource which a country possesses; the skill of the agriculturist is measured by the degree of success with which he utilises and conserves this asset. Viewed in its proper light, soil science is of fundamental importance; proper care and attention to the conservation of the soil should be quite as much a duty of a Government or of a nation as, for instance, the conservation of the mineral resources or the forests. The provision of special soil bureaus and soil surveys is a new feature of many of the more progressive countries. The further extension of such provision is bound to be only a matter of time.

This series of papers will, it is believed, assist in demonstrating the value of such work and, at the same time, serve to throw some light on the many obscure but important points which must be understood if the soil of this country is not to be a wasting asset.

I. THE CLASSIFICATION AND PROPERTIES OF MALAYAN SOILS.

BY

J. H. DENNETT,

Acting Plant Physiologist.

A. General.

In making a study of soils there are one of two usual methods of approach, that of the soil scientist and that of the husbandman.

The term soil scientist is here applied, in the restricted sense, to a scientifically trained man who has taken up the study of the soil for its own sake. His approach is concerned, primarily, with purely scientific aspects of the soil considered as an object for philosophical study, with its genetic relationships with

other soils, and the parent material from which they are formed. The interest does not lie in the fact that one soil will yield twice as much of a given crop as another soil. On the other hand the husbandman is only concerned with the soil as a medium for plant growth. His standard of classification is its utility for his own particular purpose. He feels it is of no interest to know that his soil was formed by the leaching out of one constituent, by the accumulation of another; his criteria are solely the amount of crop and pasture the earth will yield.

Which then, if the choice must lie between these two, is the better approach? The latter method offers many disadvantages when it comes to opening up new land, for at least a season, possibly many seasons must elapse before he may know definitely whether the land is suitable for his purpose. On the other hand will the pure science method take any account of the husbandman's point of view?

The solution seems to be to have husbandry as the goal and approach it through the scientific method. By scientific observation of the soil yielding a certain crop it should be possible to predict other areas suitable for that crop. The methods of investigation employed and the results obtained might be termed scientific agriculture. If scientific facts about the soil are to be collected for correlation to husbandry it is certain that these facts must be systematised.

One of the first things therefore to be evolved would appear to be a suitable classification of soils.

The Rocks as Parent Material and Soil Classification.

It was but natural that the earlier soil surveys used the geology of the parent material as a basis for classification for it seems quite reasonable that the same rock should give rise to the same soils. As work progressed came the realisation that although this was often the case, at times dissimilar rocks gave rise to the same kind of soil while similar rocks gave rise to diverse ones.

As investigation progressed it was recognised, chiefly in Russia and America in the first place, that soil could be broadly divided on a climatic basis and finally the climatic classification was evolved; more truly the classification might be called the climato-geological one for it clearly recognises that geology is concerned in the soil formed within the broad climatic basis. The older geological classification on the other hand ignored the climatic effect.

Put in its briefest terms the climatic classification recognises that a soil formed (say) from granite will be different in a dry climate from a soil formed from a similar granite in the wet tropics. Further it implies that two soils formed from granite and (say) dolorite respectively, if under the same conditions of climate, will tend, in the course of time, to become identical.

It is to be expected that mature soils formed under the same climatic conditions will bear certain general resemblances whatever their parent material while young freshly formed soils will probably differ greatly. Further, soils formed in countries of similar climatic conditions, though the countries may be on opposite sides of the earth, are likely to have many properties in common.

The Climato-Geological Classification in Outline.

"The soils of the earth may be grouped into two great divisions which are defined according to the prevailing climatic conditions as Dry or Arid soils and Moist or Humid soils"*

The great distinction between these two main groups will be that Arid soils retain a large proportion of soluble material while in the Humid soils the soluble material has been largely removed by leaching.

Arid soils usually exhibit the features of sand even when they contain large amounts of clay. To the presence of this clay the frequently surprising fertility of irrigated desert sands is due. Such water movement as takes place in Arid soils is due to upward currents with a subsequent tendency for salt accumulations near the surface following on the evaporation of the water reaching the top soil.

Humid soils on the other hand are leached out almost entirely by downward currents of water so that tendency for accumulation is likely to be in strata well below the surface.

At first sight it would appear that there must be intermediate stages even of the main grouping but it is possible to place all soils within these main divisions. Soils which become frozen in winter will be little changed during this period, while during the summer months the soil change will be governed by the lack or excess of rainfall.

Soil Zones and Regions.

A distinction is made in sub-dividing soils as to whether their properties are due to a latitudinal significance in which case soil zones are spoken of, or a longitudinal significance in which case the term used is "soil region". In general Soil Zones are greater in extent than Soil Regions.

The Soil Zones and Regions are briefly grouped as follows :

- A. The Cold Zones.
- B. Cool Temperate Zones.
- C. The Semi Arid Soils of temperate zones.
- D. Saline or Alkali Soils.
- E. Sub-Tropical Soils. (1) Sub-Tropical Red Earths, (2) Sub-Tropical Black Earths.

F. Tropical soils. (1) Humid soils, (2) Arid soils.

Consideration of space prevents discussion of the more detailed division of the above; a good detailed description and tabular classification of all known soils will be found in Rahmann's book.*

Soil Minerals.

Having discussed the general classification of soils a word must be said on the material of which they are composed.

The properties of a soil will depend to some extent on the actual minerals contained therein, their state of aggregation and the extent to which they are present.

The most important of these minerals are:—†

- (a) Quartz.
- (b) Mica.
- (c) Iron (and Titanium) minerals.
- (d) Felspars and Felspathoids.
- (e) Amphiboles and Pyroxenes.
- (f) Carbonates, Dolomites and Gypsum;
- (g) Phosphorus containing minerals.
- (h) Volcanic glasses.
- (i) Secondary minerals.

The relative importance of these, considered merely as the proportion in which they occur in soils in various parts of the world, varies greatly.

(a) *Quartz*. Crystalline Silica or Silicon Dioxide is the most widely distributed soil mineral; this is not surprising when it is remembered that it is estimated that it constitutes something like forty per cent. of the earth's crust. It is crystalline, chemically inert and is the material of what is understood as the "sand of soil" is composed generally. Though chemically inert it nevertheless plays a most important part in soil economy; aeration, drainage and secondary weathering being largely dependent on the extent to which it is present in a coarse or fine state.

(b) *Mica*. A widely distributed soil mineral; it does not occur to a fraction of the extent of Quartz. It is readily recognisable, as it occurs in small plates and is the mineral which gives the sparkling appearance to Malayan river sand. It may occur in two forms as white mica or muscovite (the commoner form) or as black mica or biotite. Chemically mica is a postassium aluminium silicate.

(c) *Iron and Titanium Minerals* are also widely distributed particularly in the wet tropics and like quartz they are chemically inert but have a great effect on the physical composition of soil; iron is responsible for the red mottling of the sand while titanium minerals generally appear as black sand particles. This is further discussed under secondary minerals.

* See foot-note on page 349.

† The order given is that of their likelihood of occurrence in Malayan soils and not soils in general.

(d) *Felspars and Felspathoids* are said to occur in all soils but in the tropics it frequently requires the eye of faith to discover them in an unchanged state. They are of great importance as they consist of potassium and sodium aluminium silicates and are hence sources of the essential mineral plant nutrient Potassium. This element occurs in the feldspars between the limits 7 and 17 per cent. with an average near 12 per cent. Calcium and Magnesium are likely to be present in feldspars but their amount is very small indeed.

(e) *Amphiboles and Pyroxenes* of which common hornblende and augite are the most important. They are essentially calcium magnesium silicates and hence are sources of two more essential elements of plant life, Calcium and Magnesium. Although they can be found in most soils in this country they form a very small percentage thereof but are still important for the reasons stated.

(f) *Carbonates, Dolomites and Gypsums*. Carbonates may occur as compounds of many metals but as far as the soil is concerned it is as calcium carbonate or dolomite (a magnesium calcium carbonate) that they are important. Gypsum is a calcium sulphate and is frequently a source of infertility in tropical soils. Gypsum may be regarded as totally absent from local soils while dolomites and carbonates are only likely to occur in certain very restricted and localised areas.

(g) *Phosphate bearing minerals*. Almost the entire phosphate content of a soil has its source in the mineral Apatite or Calcium Phosphate though it rarely appears in soil as such, especially in tropical soil where fierce weathering quickly decomposes the apatite, leaving the phosphate to be "adsorbed" by the clay of the soil. Almost all the minerals mentioned above however are subject to Apatite inclusions, and, although the amount of these inclusions are very small, they are the source of replenishment of the soil phosphate.

(h) *Volcanic glasses* are, as their name implies, minerals having no crystalline form but rather the appearance of glass; they are formed by very slow cooling during volcanic eruptions. In soil they actually have the appearance of minute splinters of glass or if they contain or have contained air bubbles they are readily recognisable under the form of pumice. These glasses contain a few per cent. of sodium, potassium, calcium and magnesium but being very resistant to weathering they can only be regarded as secondary sources of these essential elements. In this country they are only likely to occur in certain areas of Pahang and East Johore.

(i) *Secondary minerals*. Most important of these, particularly in the wet tropics, is alumina, which occurs as hydrargillite in laterites etc. Almost as important are oxides and hydroxides of iron on which the red or yellow colouration of tropical soils depends. The red colour of desert sands is due to an exterior coating of iron oxide over the quartz sand. Under this heading of secondary minerals may be placed gypsum and alkali carbonates, already mentioned above, to the former of which the infertility of much American

desert is due, while the latter forms the black alkali soils, one of the great problems of many tropical countries. These alkali soils must not however be confused with local black soils whose colour is due to an entirely different reason. In this country only alumina and oxides of iron are of any importance under this group.

The Formation of Soils.

Soils are formed in two ways, either as rock residues or as transported rock sediments.

They depend on the action of heat or cold, air and water.

(1) *Residual soils* or those formed in situ depend on the chemical and physical nature of the underlying parent rock, the temperature and moisture conditions (in arid lands on wind) and the extent to which, owing to fissures and overlying material, the rock is exposed. In the tropics elevated temperatures increase the solvent action of water and its dissolved gases oxygen, carbon dioxide and oxides of nitrogen. This is compensated for, to some extent, in temperate climates subject to frost, by the physical disintegration which occurs owing to water freezing in crevices, thus giving a continually larger surface of exposure after each frost. The solvent action of water is actually very small on hard igneous rocks but the action on the cementing material of sedimentary rocks* is frequently very rapid. It is to be expected therefore that soils formed in situ by the disintegration of the harder rocks are likely to be shallow, while those from the softer rocks are likely to be deep.

(2) *Transported soils* have in general no relation whatever to the underlying rocks, their generic relationships being with the rocks by whose disintegration they were formed. Owing to their mode of deposition transported soils frequently resemble each other, even when derived from totally different parent material. It must not be assumed however that over really wide areas these redeposited soils have identical properties, it is rather that where their environment is similar the soils will be similar irrespective of their parent material. In general they are likely to contain much fine material and much more plant nutrients than residual soils for they are formed of the material leached out and eroded from the rock by the action of water and carried by streams and rivers to some lower level where they build up flat unbroken plains.

The soil as a source and reservoir of plant food and a medium for plant growth.

The above has taken into consideration chiefly the foundation of a scientific classification but from the husbandman's point of view mention must be made of certain chemical elements as essential plant foods. These consist of potassium, magnesium, calcium, nitrogen and phosphorus and to a minor degree

*In the new Klang Road cutting at Kuala Lumpur the formation of soil from rocks of the quartzite and shale series is visible after a few months exposure.

iron and minute quantities of many others all of which are essential but whose total quantity is so small that there is little likelihood of any shortage due to exhaustion. On the other hand the economies of the first five mentioned play a most important part in the plant cycle. As far as phosphorus is concerned it is regarded at present as the limiting factor of our world, a position occupied by nitrogen in the last century. The nitrogen problem has been satisfactorily solved so that in spite of its present position it is possible that some process will be invented for the recovery of phosphates (from the sea for example).

Soil consists in the aggregate of particles ranging from 'stones' to particles so fine as to be only visible with a powerful microscope, from 'sand' to 'clay'. The finer portions of a soil are often spoken of as soil colloids, a colloid being regarded as midway between a suspension and a true solution. The formation of colloids or sands depends largely on the composition of the parent material. Quartz crystals present in the original rock as such are subsequently found in the soil as such. The clay or colloid is formed by the decomposition of complex aluminium silicates such as felspar mentioned above. On weathering these complex silicates break down, losing their more soluble potash, soda, etc., leaving behind aluminium silicates or clay. It is the portion of the soil which does not settle readily in water and for this reason is liable to be carried off in stream water (in which case it will be subsequently deposited as an alluvium). The important thing about the colloid as at present being discussed is that it has the property of "adsorbing" into itself many mineral and organic salts, that is to say it retains these salts with a definite force against the action of leaching water. This does not mean that water has no leaching action in removing salts from the soil but that its effect is considerably slowed down by this competitive action of the colloid. All the potash, magnesium etc. retained by the soil in a form immediately assimilable by plants is retained by adsorption. In addition to this adsorptive capacity for salts the water retaining capacity of a soil depends almost entirely on the amount of the colloid. Soil aeration on the other hand will depend on the presence of sand and gravel.

The picture therefore is of sand and gravel and colloid forming a homogeneous mixture-soil; a slow leaching out of salts absorbed by the colloid and a slow replacement by the weathering of the mineral particles mentioned under the heading of soil minerals. The phrase homogeneous mixture is only partly true for there are nearly always variations with depth. The section of a soil from the surface to the rock face beneath is known as "a soil profile".

Usually the soil at the surface and for a depth of six inches or so is darker in colour than that at greater depths, due to the presence of organic matter. The change to the lighter colour may be imperceptibly gradual or it may be sharply defined or in this country it frequently happens that there is no visible change, the organic content being small and not deeply coloured.

At a lower depth there may be an accumulation of some mineral compounds which may show as a band or there may be a layer which has been leached. These various bands down the profile are known as horizons. In this country they are often absent, the only two distinctions it is possible to make in such cases being soil and rock.

Two soils are of especial interest in this connection, the Podsoles and Laterites.

The former which do not occur in this country have a surface layer from which the iron and alumina has been largely leached leaving a preponderance of silica. Beneath is a "pan" consisting of soil which has been cemented together by humus leached from above.

The laterites are generally considered as soil from which the silica has been leached leaving iron and alumina. Local observations shew, however, that laterite can be formed by the leaching of iron and alumina from a top soil with subsequent accumulation of iron and alumina at a lower level.

The texture of a soil depends on a number of factors, on the amount of sand, silt and clay and the ratios between them, *i.e.* (its mechanical composition) and also on the state of aggregation. Small particles are frequently cemented together to form a larger particle, this, as far as aeration, drainage etc. goes, having the properties of the larger particle. This type of aggregation is spoken of as 'crumb structure'. In soils possessing this crumb structure ordinary mechanical analysis is often deceptive as the crumb is broken down during the analysis into smaller components and the soil is returned as much heavier than it actually is.

The function of soil analysis may be to classify soils in the general scheme or more generally to enable the husbandman, by reference to a series of defined standards, to ascertain the nature and requirements of his soil. Analysis falls under three heads: mechanical, chemical, mineralogical. The first of these divides the soil into a number of fractions between certain limits of size, gravel, sand, fine-sand, silt, clay. From the figures obtained it is possible to get some idea of a soil "lightness", "heaviness", drainage capabilities etc.

It is only an approximation for there will be a continual variation of particle size within any given limits; a fact which ordinary mechanical analysis does not shew. It takes no account of the aggregation or crumb structure mentioned above.

Chemical analysis on the other hand aims at shewing the amounts of plant nutrients present in the soil both in respect of the total amount and the amount in a state to be immediately taken up by the plant. The former is usually spoken of as the "total" the latter as the "available".

Mineralogical analysis on the other hand is concerned with the minerals in the soil, in their original state, a state in which they will not be likely to appear under the heading of "total" or "available". It is concerned with the ultimate as opposed to the immediate food reserves of the soil.

* An exception is Raub low level soils discussed below.

(A) *Granite Soils*. Light coloured, well drained and containing almost equal proportions of clay and sand. No definite distinction is made of low level granite soils, but where such soils do occur in broad valleys there is an increase in the silt and clay. In narrow gorges this is reversed and there is a large decrease in the latter owing to the scouring action of stream water.

(B) *The Quartzites*. (i) Hill Soils generally have a low percentage of coarse sand and this tends to close packing down helped by rather complete absence of crumb structure. They show considerable variation in proportion of fine sand, silt and clay at times shew a narrow band of laterite an inch or two in thickness at about eighteen inches below the surface. This band, however, is too thin to have any effect agriculturally.

(ii) Valley soils are extremely variable and frequently shew such undesirable features as carbonaceous shales which, in the limit, result in soils with a high percentage of free carbon, which are almost completely sterile. Iron sulphide is sometimes present which on opening up is oxidised with the formation of free sulphuric acid leading to disastrous effects on vegetation.

(C) *Raub Series Soils* (i) High level soils appear largely derived from phyllites, * though the other contemporaneous rocks appear to give this type of soil. They are characterised by the occurrence of a layer of laterite (in the popular sense) often sufficiently thick to interfere with sampling and agriculture generally, at a depth of some eighteen to thirty inches. The soils are usually of a deep red colour and have a good crumb structure; hence they contain much more clay than their texture leads one to suppose.

(ii) Low level soils are not usually connected with the underlying rock but are really a recent inland alluvium overlying (generally) a limestone floor. It is however convenient to group them with the Raub series as they always occur overlying rocks of this age. They are usually whitish yellow in colour with a fairly open texture and indifferent agricultural properties.

(D) *Coastal Alluvium*. (i) Coastal clays; under undrained conditions the surface soil is of a grey colour changing to blue or blue green at the permanent water table. On draining they present a mottled appearance. Shallow peat layers are frequent. Sulphur compounds are of common occurrence.

(ii) Peat needs little explanation, it generally lies contiguous to the inland quartzite soils.

(iii) Organic soils have properties midway between those of peat and clay. The coastal alluvium can be regarded as the richest soil in Malaya but owing to heavy texture its drainage is restricted.

(E) and (F) Both the Pahang Volcanic soils and the Dolorite soils occur chiefly in Pahang. The former appear to be richer in total potash than usual while the Dolorite soils shew unusual texture and are remarkable for the large quantity of phosphates they contain. Their area is very restricted however.

* *Phyllites*. So called from their tendency to split in planes. They are argillaceous rocks.

(G) *Highland Soils* are generally granites and are very immature. Chemically they are somewhat richer in nutrients and have larger amounts of decaying vegetable material on the surface than the corresponding soils of the plains but they are essentially the same.

Texture and Drainage.

Mention has been made above of texture and drainage. Nearly all Malayan inland soils are of open texture and are, in consequence, very free draining. Even in the case of the quartzites which tend to 'pack' there is a good water movement. This, with Malaya's heavy rainfall, tends to intensify leaching and, on steep slopes, may cause all the effect of drought when the soil is exceptionally sandy owing to the rapid penetration and run off. In a case at the Forest Research Station at Kepong quite good growth was obtained on the flat top of a hill where all the original top soil has been removed, while on the steep slopes growth was incredibly bad. Heavy manuring with cattle manure had no effect and the trouble was eventually traced to the lack of water retentive power on the steep slopes.

In this connection also is the growing conviction among planters that oil palms will not give as high yields on hills as on gently undulating to flat land.

On flat land the problem, particularly with coastal alluvial soils (the major portion of flat land), is reserved and much depends on getting sufficient drainage for successful agricultural operations.

This problem is considerable and a number of investigations in connection with it have been started. Artificial soils made up in the laboratory at first proved to be as freely draining as the inland soils but after some months they gradually settled and compacted until now after a period of eighteen months drainage is extremely small. It would appear likely that much drainage of these coastal clays is made possible by the action of roots and worms which form drainage channels and, in the case of freshly drained land, to the action of crabs. On the other hand on well drained land at the Klang Coconut Station a carefully prepared profile shewed little signs of root and worms below about 18 to 24 inches.

Drainage and observation on a bigger scale have been started at the above Station, observations being made on the drainage levels at different tide phases and in connection with incidence of rainfall.

Further laboratory observations have shewn that there are great differences in the drainage rates of coastal soils under the same conditions of temperature and composition.

Much has been written about the addition of organic matter lightening the texture of a soil and so effecting drainage. This cannot be said to hold at all in Malaya except in the case of peats.

Peats have already been mentioned above in connection with general remarks on coastal alluvials. In addition to these coastal peats, however, there are hill peats (not the hoch-moor peats of temperate climates but those bearing a close relationship with those of the plains). With hill peat, preservation is largely due to the lower temperatures experienced; with coastal peats, on the other hand, preservation has been largely due to the fact that they were water logged. Two types can be recognised: an acid peat and one with an almost neutral reaction. The acidity of the former is very high (up to pH 1.5) and appears to be probably due to partial drying out of peats containing sulphur compounds. During the drying out phases these sulphur compounds are oxidised to free sulphuric acid with subsequent ill effects on vegetation.

Too rapid draining of peat areas is frequently disastrous as there is a rapid shrinking to a dry powder, (which is then subject to considerable oxidation) which it is almost impossible to recondition.

Inland Soils.

In considering the actual composition of Malayan soils it is well to bear in mind that, in spite of the "luxurious tropical vegetation", with which they are frequently covered, they cannot be considered as highly fertile. Soils having the properties of Malayan soils would be rejected as worthless in Western Europe. Intense leaching keeps the amount of available plant food at a minimum, and it is only because intense leaching is accompanied by intense weathering of the small amounts of plant foods which are in combination as complex minerals, that local soils have some semblance of fertility.

The so called "total" mineral plant foods cannot be regarded as at all high with one or two exceptions. Figures are given in the table below:

		Lime (CaO) per cent.	Potash (K ₂ O) per cent.	Phosphates (P ₂ O ₅) per cent.
Quartzite	...	up to 0.05	0.10	up to 0.02
Granite	...	up to 0.04	0.05	0.02
Raub (High)	...	up to 0.03	0.50	0.03
Coastal (heavier)	...	0.13	0.80	0.04
Coastal (lighter)	...	0.02	0.20	0.02
Pahang Volcanic	...	0.04	0.70	0.06
Dolorite	...	0.05	0.30	1.00

The "available" plant food, i.e. that contained in the colloid complex as simple salts in a form readily assimilable by the plant is not more than a tenth of these figures.

The variation of both "total" and "available" mineral nutrients with depth is likely to vary with the particular soil concerned. A soil of the quartzite series formed from soft rock tends to shew an evenness of chemical analysis over a considerable depth. On the other hand a soil of the granite series being formed

from a harder rock tends to shew an amount of deterioration (in the sense of availability) with depth. This is because the rock complex is less easily broken down and hence the biggest changes are at the point of maximum attack by weather.

The Raub high level series represent yet a different mode of weathering. There are definite layers of accumulation and/or leaching. The effect of the intense climatic conditions has been to accumulate a ferruginous layer at some thirty inches below the surface or again the intense leaching may have the effect of removing much of the silica in solution leaving a high concentration of iron and alumina.

Soil Bases and Acidity.

Much is written of soil "bases" now-a-days. By this term is meant the Calcium, Lime, Potash, Magnesia and Soda which the soil contains in simple combination; not as complex components of soil fragments. Base and alkali are roughly the same in chemical parlance and are regarded as the antithesis of acid. Soil acidity has a different significance in the tropics compared with temperate climates. The standard of acidity almost universally accepted to-day is the pH scale; a soil of about pH 7.5 has a neutral action, one with a higher figure than this will be alkaline, with a lower figure acid. Further this scale is logarithmic *i.e.* each progressive change of 1.0 meaning a tenfold increase or decrease in acidity or alkalinity. Most inland Malayan soils have pH values of 4.5—5.5 apparently well on the acid side. The simplest way is to regard them as acid but not sour, the difference being possibly well expressed by the Malay word "assam" as opposed to "busok". Again in this connection the lime requirement, as estimated by methods consistent with agricultural practice in Europe, shews, in parallel with the pH figures, values up to 20 tons per acre, a figure which is quite prohibitive in cost in the first place and in the event of such an application, may result in permanent impoverishment, the lime turning out the other "bases" essential to plant growth. The explanation of the harmlessness of the acidity of the average Malayan soil would appear to be rather as follows.

The acidity may be regarded as in two parts, (i) the soluble part and (ii) the insoluble part. The soluble part is that contained in the soil solution. It is with this portion that the plant is concerned. The concentration of this soluble portion is small. The insoluble part is intimately attached to the envelope of the soil particle and does not directly affect the plant. The insoluble portion has the greater effect on pH and lime requirement measurements. In this connection must be mentioned the buffer action of soils, most simply defined as the resistance of soils to changes of pH (*i.e.* of acidity or alkalinity) on the addition of acids or alkalis. This has some considerable importance in connection with manurial programmes for if a soil is but poorly buffered the

addition of (say) Ammonium sulphate (a physiologically acid manure) will tend to make the soil more acid so that it may therefore be necessary to add lime to neutralise this effect. If on the other hand a soil is highly buffered this addition of lime is unnecessary. This is a point which is not too fully recognised locally.

There are occasional instances where the soil acidity is definitely harmful; frequently in such cases the pH is 3.5 or less and there is usually in such instances a high concentration of acid in the soil solution. This is generally present as free Sulphuric acid, formed frequently where there are old nipah stumps and similar vegetation, containing amounts of sulphur compounds which are subsequently oxidised, (when the stumps are killed), to sulphuric acid. This type of acidity nearly always occurs on coastal alluvials. Occasional examples of a similar nature have been found on quartzite valley areas. The cause appears to be similar though in this case it is likely that the sulphur before oxidation, is present as pyrites.

Malayan and Other Soils.

How do Malayan soils compare with those of other tropical countries and those of temperate climates?

It must be constantly borne in mind that Malayan soils are mature* and that they have undergone and are undergoing continuous intense leaching. They have little chance of any recuperation in the sense of lying fallow, with the exception of rice areas, and, unlike many parts of the tropics, they have no source of renewal from volcanic ashes. There is a continual replenishment of soil in some countries from this source. In temperate climes such volcanic dust is regarded as infertile but under intense tropical conditions there is a rapid break down to the state where its contained minerals are in an available form. In Sumatra, conditions are much more closely ailed to those of Malaya; Java on the other hand is largely actively volcanic and is therefore much more fertile. Many parts of West Africa have similar climatic conditions to Malaya and the soils from all accounts appear similar though not necessarily so mature.

As has been stated above, compared with temperate countries, the soils of Malaya must be regarded as poor. Practically all the inland soils would be looked on with contempt by the average European or American farmer, for Malayan soils as they are now, if transported to cooler climates, would prove extremely barren. They depend for their alleged fertility on optimum conditions, as far as temperature and rain goes, for plant growth, and on the intensive weathering always rendering small amounts of plant food available in our local soil.

* Mature is here used in contradistinction to young or freshly formed soils. They are in an advanced stage of weathering and shew little tendency towards change.

Organic Matter and Nitrogen.

Much has been said above about mineral plant foods but little has been said about the essential nitrogen and the role of organic matter in soil.

Organic matter comprises all the decaying vegetable and animal material contained in the soil. It is not synonymous with "humus". Humus is organic matter in a definite and more simplified state. It is the organic matter which has been broken down to the extent that it can enter into loose combination with soil bases etc. and into a loose combination with the colloid complex. When the soil is normal the ratio of the total nitrogen to the total carbon (themselves rough measures of organic matter) is about 11.0. Many quartzite valley soils shew a figure greatly in excess of this due largely to the presence of free carbon.

The nitrogen in the soil is continually changing i.e. it is dynamic but if measured by analysis over long periods practically no difference would be found year by year, for each portion of nitrogen converted to the form of say nitrate is largely replaced by fresh organic matter entering the soil from decaying vegetable material.

Nitrogen is present in many forms in the soil; as gaseous nitrogen in the soil air, in combination in organic matter, as nitrate, as ammonia and as nitrites. There is a constant change between all these different states, organic nitrogen being converted to ammonia and subsequently oxidised to nitrates. Nitrates are reduced under flooded conditions to nitrite and ammonia, the reverse happening when the soil dries out again. But in spite of all these changes the picture is static. The nitrogen content of individual inland soils tends to shew stationary figures for total nitrogen for nitrates and for ammonia. On coastal soils subject to flooding and on rice soils there will be a change from nitrates to ammonia when flooded and from ammonia to nitrates when wet.

The nitrogen content of inland soils is from 0.1 to 0.2 per cent. and of coastal soil from 0.15 to 0.4 per cent. A detailed discussion of nitrogen will be given in the third paper of this series.

RESULTS ON STEM BORER EXPERIMENTS IN KRIAN DURING THE 1931 - 1932 PADI SEASON

Compiled By
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from
The Records Obtained,
by
H. T. PAGDEN,
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Introduction.

This report is based on the records left by Mr. H. T. Pagden, formerly Assistant Entomologist, to whom full credit must be given for all these records, since he was responsible for recording the data and for supervising the investigation of padi borers in the field.

The writer would like to place on record his appreciation of the work which Mr. Pagden has performed in endeavouring to obtain information for the control of padi borers during the past two years.

Experiments.

Four experiments were laid down for the 1931—32 padi season at the following places in Krian:—Bagan Tiang (Swee Lee Estate), Titi Serong Experimental Station and 12th mile Bagan Serai.

Experiment I - Yields.

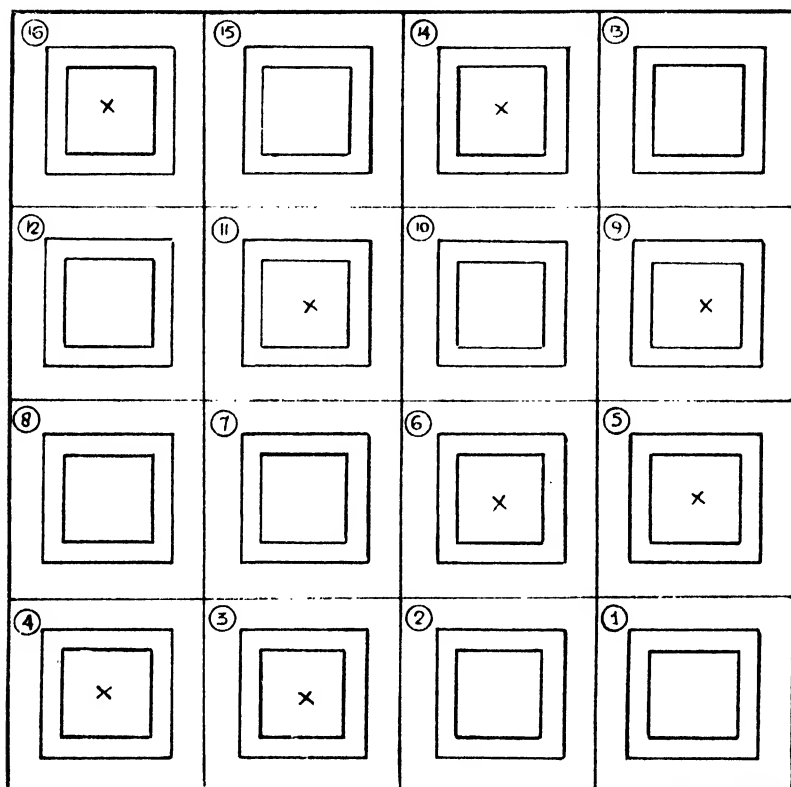
This experiment was for the purpose of comparing yields from non-colonised areas and areas colonised with the parasite, *Trichogramma minutum*.

This area of 16 acres was situated on Swee Lee Estate, Mukim of Bagan Tiang. It was sub-divided into one acre blocks. In the centre of each acre a 1/10 acre plot was measured and over 8 of these 1/10 acre plots parasites were liberated at the rate of 20,000 per tenth acre. In the middle of each 1/10 acre plot a 1/40 acre plot was reserved for the purpose of calculating yields: stem counts were made from all 16 plots.

The type of padi used in this area was Seraup kechil 36. Seeds were sown on July 12th, 1931. The first transplanting was carried out on July 21st and the second on July 25th, 1931. The planting of the 16 acres commenced on September 28th and was completed on October 4th, 1931. The 1/40 acre plots were planted with 432 plants—a spacing of 18 inches.

No egg masses of stem-borer moths were collected from these plots.

**Diagram illustrating the arrangement of the plots
in Experiment I.**



Trichogramma was liberated over the plots marked x.

Liberation of Parasites:—The liberation of parasites commenced on December 3rd, 1931, in Plot 14 and ceased on December 18th, 1931, in Plot 11. Eight Plots, Nos. 3, 4, 5, 6, 9, 11, 14 and 16, were colonised and two circuits of liberations were made, 20,000 parasites being liberated in each 1/10 acre, equivalent to 200,000 per acre.

Stem Counts:—Stem counts were made from 1/10 acre plots. The work was commenced on January 25th. Twenty plants were taken from each 1/10 acre plot in one day, making altogether 320 plants from this area. Counting was commenced on January 26th and was completed on February 13th. The following figures show the result of the count from colonised and uncolonised areas:—

No. of tillers.	COLONISED AREA.			
	No. of tillers attacked.	Total No. of <i>Diatraea</i> , larvae and pupae found.	Total No. of <i>Sesamia</i> , larvae and pupae found.	Total No. of <i>Schoenobius</i> larvae and pupae found.
1839	1358 = 73.84 per cent.	395 larvae, 19 pupae	5 larvae	30 larvae
1804	UNCOLONISED AREA.			
	No. of tillers attacked.	Total No. of <i>Diatraea</i> , larvae and pupae found.	Total No. of <i>Sesamia</i> , larvae and pupae found.	Total No. of <i>Schoenobius</i> larvae and pupae found.
	1393 = 77.21 per cent.	816 larvae, 9 pupae	1 larvae	60 larvae 4 pupae

A very slight decrease in the percentage of attacked tillers in the Colonised Area is revealed and more larvae of *Diatraea* and *Schoenobius* were formed in the Uncolonised than in the Colonised area.

Harvesting:—Harvesting of the 1/40 acre plots was commenced on February 22nd and was completed on February 25th.

The results are summarised thus:—

Plots receiving parasites:—493 plants (3456 planted) yielded about 3.5 gantangs of padi = 0.11 paus per plant.

Plots not receiving parasites:—484 plants (3456 planted) yielded 3.6 gantangs of padi = 0.12 paus per plant.

Out of 3456 plants planted only 493 in the Colonised area and 484 in the Uncolonised area remained. A considerable amount of rat damage occurred and this was followed by the growth of grasses and "menderong" which caused the padi to die. The plants harvested were alive but their appearance was very poor.

Experiment II—Natural and Induced Parasitism.

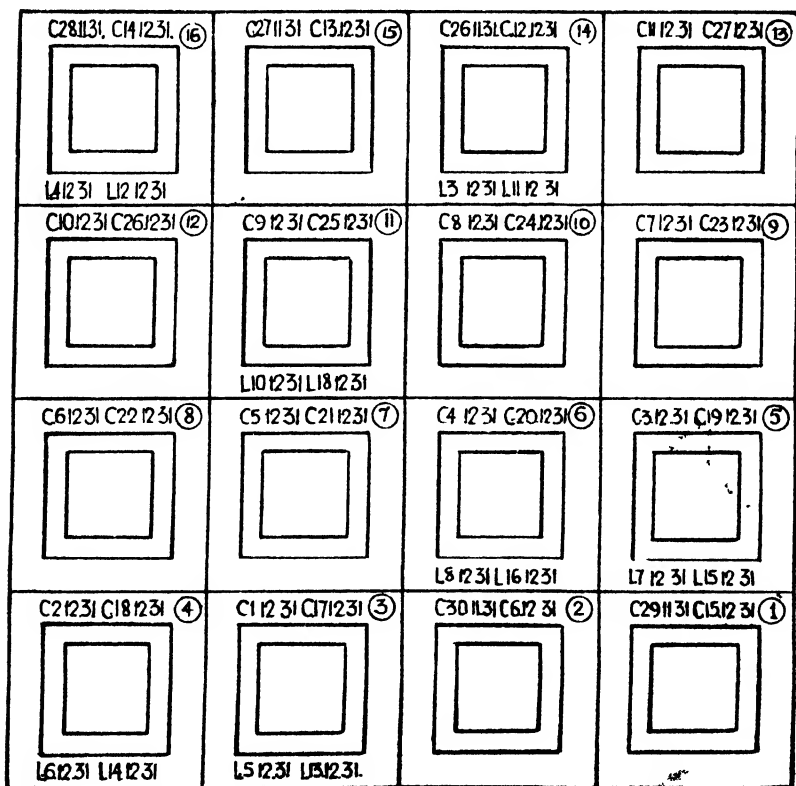
This area was situated adjacent to the area selected at Swee Lee Estate for Experiment I and the lay-out of this Experiment was similar to that described in Experiment No. 1. On eight 1/10 acre plots *Trichogramma* was liberated and coolies were employed to collect egg masses of stem borer moths from all the sixteen plots.

Seeds were sown on July 11th, 1931. The first transplanting was carried out on July 20th and the second on July 24th, 1931. Planting was commenced on September 22nd and was completed on October 10th, 1931.

Collection of Egg Masses:—Collection of egg masses was started on October 12th in Plot No. 1 and ceased on December 27th in Plot 13. The collection was discontinued when the padi was about to flower.

Egg masses of *Diatraea* were first collected on October 29th in Plot 2. *Schoenobius* first occurred on October 23rd in Plot 12. It is interesting to note that, although *Chilo* egg masses were collected in this area, they were not obtained in two other areas where egg collecting was carried out. *Chilo* egg masses were usually found on "menderong" (*Scirpus grossus*). *Diatraea* egg masses appeared to increase in December, the highest number collected in one day being 95 in Plot 15 on December 13th. *Schoenobius* remained more or less constant, the highest number being 24, collected from Plot 9 on December 23rd. The first *Chilo* egg mass was collected in Plot 7 on October 18th. The largest number collected on one occasion was ten.

Diagram illustrating the arrangement of the plots in Experiment II.



/ C = Dates of collection of egg masses.

L = Dates of liberation of parasites,

Liberation of Parasites:—Liberation of parasites commenced on December 3rd., 1931, in Plot 14 and ceased on December 18th. in Plot 11. The liberation was so arranged to avoid liberations and collections in the same plot on the same day. The collection of ova continued until December 27th., so that egg masses from each plot were collected once after the liberation of parasites. Eight plots, Nos. 3, 4, 5, 6, 9, 11, 14 and 16, were colonised and two circuits of liberations were made, 20,000 parasites being liberated altogether in each 1/10 acre plot equivalent to 200,000 per acre.

The results are tabulated herewith:

(1) Parasitism of *Diatraea* Egg Masses.

COLONISED PLOTS.			UNCOLONISED PLOTS.	
Plot No.	Percentage of Parasitism before liberation.	Percentage of Parasitism after liberation.	Percentage of Parasitism during first circuit.	Percentage of Parasitism during second circuit.
1			21.4	44
2			11.7	33.3
3	0	26.4		
4	40	46.4		
5	5.34	36.5		
6	45	50		
7			32.2	41
8			50	73
9	37	42.5		
10			46.8	65.7
11	61.7	73		
12			81.5	62.2
13			17.7	43.2
14	20	35.7		
15			30	50.5
16	20	25		

Colonised Area:—In the circuit immediately prior to the liberation of parasites, 192 egg masses, of which 78 were parasitised, i.e. 40.6 per cent. parasitism, were collected from those plots intended for colonisation. After the liberation of *Trichogramma* 397 egg masses were collected from the colonised plots of which 158 were parasitised, a percentage of 39.8. This result indicates that the percentage parasitism was not increased by the introduction of parasites.

Uncolonised Area:—In the first circuit 304 egg masses were collected of which 142 were parasitised, giving a percentage parasitism of 46.7. In the second circuit 371 egg masses were collected of which 198 were parasitised, a percentage of 53.4.

The above figures show that an increase of about 7 per cent. in natural parasitism occurred during the interval between the first and second circuits in the uncolonised plots. This, however, was not recorded in the plots which received parasites.

(2) Parasitism of *Schoenobius* Egg Masses.

COLONISED PLOTS.			UNCOLONISED PLOTS.	
Plot No.	Percentage of Parasitism by <i>Trichogramma</i> before liberation.	Percentage of Parasitism by <i>Trichogramma</i> after liberation.	Percentage of Parasitism by <i>Trichogramma</i> during first circuit.	Percentage of Parasitism by <i>Trichogramma</i> during the second circuit.
1			33.3	76.9
2			50	38.4
3	0	71.4		
4	100	63.6		
5	0	64.2		
6	0	100		
7			100	94.1
8			0	100
9	44.4	66.6		
10			75.0	66.6
11	100	61.5		
12			80	100
13			18.1	61
14	0	85.7		
15			100	100
16	0	80		

Colonised Plots:—Before liberation 22 egg masses were collected of which 9 were parasitised by *Trichogramma* giving a percentage parasitism of 40.9. After the liberation of parasites, 86 egg masses were collected of which 60 were parasitised by *Trichogramma*, a percentage of 69.8. This result indicates that the parasitism increased by 29. This, however, may be due to an increase in natural and not to induced parasitism (see below).

Uncolonised Plots:—During the first circuit 44 egg masses were collected of which 27 were parasitised by *Trichogramma*, giving a percentage parasitism of 61.4.

During the second circuit 101 egg masses were collected of which 74 were parasitised by *Trichogramma*, a percentage of 73.3. The natural parasitism would appear to have increased by about 12 per cent. indicating that the liberation of parasites was responsible for 17 per cent. of *Schoenobius* egg masses being parasitised.

(3) Parasitism of *Chilo* Egg Masses.

The number of *Chilo* egg masses collected from all 16 plots was 68. Only one and that from the Uncolonised area was parasitised by *Trichogramma*. This result indicates that *Trichogramma* is not an active parasite of *Chilo*. *Phanurus* emerged from 33 egg masses—a percentage of 48.5.

The following figures are the records of egg collections made during the period October 12th, 1931 to December 27th, 1931, from the Colonised and Uncolonised plots.

Diatraea.

Colonised Plots.	Uncolonised Plots.
Total No. of egg masses 664	Total No. of egg masses 748
Total No. of masses with <i>Trichogramma</i> , 256 = 38.6 per cent.	Total No. of masses with <i>Trichogramma</i> , 377 = 50 per cent.
Total No. of masses with 50 per cent. parasitism or over 193 = 29.1 per cent.	Total No. of masses with 50 per cent. parasitism or over 275 = 36.8 per cent.

Schoenobius.

Colonised Plots.	Uncolonised Plots.
Total No. of masses 120	Total No. of masses 166
Total No. of masses with parasites 82 = 68.3 per cent.	Total No. of masses with parasites 114 = 68.7 per cent.
Total No. with <i>Trichogramma</i> 69 = 57.5 per cent.	Total No. with <i>Trichogramma</i> 98 = 59 per cent.
Total No. with <i>Phanurus</i> 8 = 6.7 per cent.	Total No. with <i>Phanurus</i> 5 = 3 per cent.
Total No. mixed with <i>Trichogramma</i> and <i>Phanurus</i> 5 = 4.2 per cent.	Total No. mixed with <i>Trichogramma</i> and <i>Phanurus</i> 11 = 6.6 per cent.

The liberation of *Trichogramma* over the Colonised Plots commenced on December 3rd and continued until December 18th so that these figures cannot be said to reveal the difference between the Colonised and the Uncolonised areas since the collection of egg masses was done only once after the liberation of *Trichogramma*.

Stem Counts :—Stem counts were made from all 1/10 acre plots. The work was commenced on January 20th. Twenty plants were taken from each 1/10 acre plot on one day, making altogether 320 plants from this area. Counting was commenced on January 26th and was completed on February 13th. The following figures show the results of the counts of stems from the Colonised and Uncolonised areas.

Colonised Area.	Uncolonised Area.
No. of tillers 2368	No. of tillers 2508
No. of tillers bored 1687 = 71.2 per cent.	No. of tillers bored 1693 = 67.50 per cent.
No. of <i>Diatraea</i> larvae 586	No. of <i>Diatraea</i> larvae 663
No. of <i>Diatraea</i> pupae 25	No. of <i>Diatraea</i> pupae 9
No. of <i>Sesamia</i> larvae 9	No. of <i>Sesamia</i> larvae 7
No. of <i>Sesamia</i> pupae Nil	No. of <i>Sesamia</i> pupae Nil
No. of <i>Schoenobius</i> larvae 29	No. of <i>Schoenobius</i> larvae 36
No. of <i>Schoenobius</i> pupae 1	No. of <i>Schoenobius</i> pupae 2

This result shows a greater percentage of bored tillers in the Colonised than in the Uncolonised area.

Harvesting:—Harvesting of the 1/40 acre plots was started on February 14th, 1932, in Plots Nos. 13 and 14 and was completed on February 20th, 1932.

The yields from plants in the Colonised and Uncolonised plots were as follows:—

COLONISED AREA.					UNCOLONISED AREA.				
Plot No.	Yield				Plot No.	Yield			
	Gantang	Chupak	Paus	No. of plants		Gantang	Chupak	Paus	No. of plants
3	5	1	1	374	1	6	2	1	408
4	3	3	0	399	2	6	0	3	413
5	2	1	1	365	7	4	1	2	360
6	1	3	1	375	8	1	3	0	381
9	2	2	2	370	10	1	3	3	363
11	0	3	0	182	12	0	3	0	313
14	2	0	2	360	13	3	2	3	362
16	3	2	0	369	15	3	3	0	384
	22	0	3	2,794		29	0	0	2,984

Plots receiving parasites:—2794 plants (3456 planted) yielded about 22 gantangs of padi = 0.13 paus per plant.

Plots not receiving parasites:—2984 plants (3456 planted) yielded 29 gantangs of padi = 0.16 paus per plant. This result shows a lower yield from those plots over which parasites were liberated.

It will be seen that out of 3456 plants planted only 2794 and 2984 remained in the colonised and uncolonised plots respectively. A considerable amount of rat damage occurred which was followed by the appearance of grasses and 'menderong' causing the padi to die.

Experiment III - Seasonal Occurrence of Borers.

The purpose of this experiment was to ascertain whether stem borers were seasonal. Last season's work indicated that irrespective of the condition of padi, stem borers may be seasonal.

Schoenobius became numerous in late December, 1930, *Diatraea* in January, 1931, when collection ceased.

Two 1/6 acre plots were reserved, one at Swee Lee Estate and the other 13 miles away in a south easterly direction at 12th. mile, Bagan Serai. The type of padi used was Seraup Kechil 36 at Swee Lee Estate and Seraup Besar at Bagan Serai. It was intended to plant the same variety, but, since all the padi had been planted at Bagan Serai, there was no alternative but to select 1/6 acre which had been planted with Seraup Besar.

Five coolies were employed at each area for collecting egg masses until the padi plants died.

The collection of egg masses was commenced at both places on October 12th., 1931, and ceased on March 31st., 1932.

The figures below show the total number of egg-masses collected in each month.

SWEE LEE ESTATE.			BAGAN SERAI.		
Period	<i>Diatraea</i>	<i>Schoenobius</i>	Period.	<i>Diatraea</i>	<i>Schoenobius</i>
October 31 ...	45	3	October 31 ...	42	103
November 31 ...	153	12	November 31 ...	507	563
December 31 ...	1,389	71	December 31 ...	570	279
January 32 ...	90	16	January 32 ...	285	101
February 32 ...	105	0	February 32 ...	531	17
March 32 ...	432	27	March 32 ...	437	7
Total ...	3,025	129	Total ...	2,372	1,070

The above figures show that the largest number of *Diatraea* egg masses collected from both areas was in December, 1931, with 1389 at Swee Lee Estate, and 570 at Bagan Serai. The minimum number collected from both areas was in October with 45 masses at Swee Lee and 42 at Bagan Serai. One egg mass of *Diatraea* was collected at Bagan Serai on the day the collection commenced (October 12th.) but at Swee Lee none was collected until October 17th.

Egg masses of Diatraea at Swee Lee Estate:—During October 45 egg masses of *Diatraea* were collected at Swee Lee, 10 being the maximum in one day. During most of November the numbers remained constant but at the end an increase occurred. The number of egg masses remained high throughout December and commenced to decrease at the beginning of January but there was a large rise in the last week of January. The number of egg masses was low throughout February and this was maintained until about the last week of March, when an increase occurred.

Egg masses of Diatraea at Bagan Serai:—The number of egg masses collected was low throughout October. A marked increase occurred about the third week of November. During December the number fluctuated but decreased considerably towards the end of the month and during January. An increase commenced at the beginning of February, remaining fairly high throughout the month. Towards the end of March the numbers again increased.

There would appear to be evidence to suggest that *Diatraea* moths are more numerous in some months than in others. From both these areas the largest number of eggs was collected in December. Results in 1930—1931 however, showed that the increase occurred in February.

Schoenobius at Swee Lee:—The egg masses for *Schoenobius* in this area were lower than at Bagan Serai throughout the season. The largest number (71) was collected in December and 10 was the largest number collected on one day (December 13th.). An increase occurred in March.

Schoenobius at Bagan Serai:—The largest number (563) was collected in November. The largest number collected in one day was 61 on December 12th. From this month the collections decreased, only 7 masses were collected in March. In 1930-31 season, most *Schoenobius* egg masses were collected about the end of January and the beginning of February but this season's collections show that at Swee Lee and Bagan Serai, November for the former and December for the latter were the peak months and not January and February. Considerably more work is undoubtedly required to ascertain the causes responsible for seasonal fluctuations.

The natural parasitism of the egg masses collected at Swee Lee Estate and Bagan Serai gave the following result.

1. *Diatraea* Egg Masses.

Period.	Total No. of masses.	Total No. of masses with <i>Trichogramma</i> .	Per cent.	Total No. of masses with 50 per cent. parasitism or over.	Per cent.
October ...	45	Nil	—	Nil	—
November ...	153	3	2.0	3	2.0
December ...	1,389	184	13.2	64	4.6
January ...	901	418	46.4	225	25.0
February ...	105	48	45.7	32	30.5
March ...	432	190	44.0	113	26.2
Total ...	3,025	843		437	
October ...	42	2	4.8	1	2.4
November ...	507	106	20.9	24	2.7
December ...	570	231	40.5	100	17.5
January ...	285	83	29.1	27	9.5
February ...	531	48	9.0	11	2.1
March ...	437	180	41.2	113	25.9
Total ...	2,372	650		276	

At Swee Lee the total number of egg masses collected was 3025 out of which 843 were parasitised by *Trichogramma*, a percentage parasitism of 27.9. Out of the 843 masses, 437 (= 14.4 per cent.) showed 50 per cent. parasitism or over.

At Bagan Serai the total number of *Diatraea* egg masses collected was 2372, of which 650 (= 27.4 per cent.) were parasitised by *Trichogramma*. Out of the 650 masses, 276 (= 11.6 per cent.) showed a 50 per cent. parasitism or over.

The largest number of parasitised egg masses at Swee Lee occurred in January; out of 901 egg masses, 418 were parasitised and 225 of these showed 50 per cent. parasitism or over. The parasitism during January and March remained about 40 per cent. At Bagan Serai the parasitism was lower than at Swee Lee and parasitism only in December and March reached 40 per cent. During March 437 egg masses were collected, 180 contained parasites of which 113 showed a 50 per cent. parasitism or over.

Out of the total number of *Diatraea* egg masses collected at Swce Lee and Bagan Serai only one egg mass collected at Bagan Serai was parasitised by *Phanurus beneficiens*, so that this parasite is not an active enemy of *Diatraea*.

2. Schoenobius Egg Masses.

PERIOD		SWEE LEE ESTATE.					
		Total No. of masses	Total No. of masses with parasites	Total No. of masses with Trichogramma	Total No. of masses with Phanurus	Total No. of masses mixed with Tric. & Phanurus	Total No. of masses mixed with Tetrastichus & Trichogramma
October	...	3	—	—	—	—	—
November	...	12	1	—	1	—	—
December	...	71	14	13	1	—	—
January	...	16	8	6	—	2	—
February	...	0	—	—	—	—	—
March	...	27	18	10	2	1	1
		129	41	29	4	3	1

PERIOD		BAGAN SERAI.							
		Total No. of masses	Total No. of masses with parasites	Total No. of masses with Trichogramma	Total No. of masses with Phanurus	Total No. of masses mixed with Tric. & Phanurus	Total No. of masses with Tetrastichus	Total No. of masses mixed with Tet. & Tric.	Total No. of masses mixed with Tetra & Phanurus
October	...	103	7	—	7	—	—	—	—
November	...	563	140	38	89	13	—	—	—
December	...	279	185	46	98	41	—	—	—
January	...	101	72	7	44	13	3	3	2
February	...	17	5	1	2	1	1	—	—
March	...	7	4	1	1	1	1	—	—
		1,070	143	93	241	69	5	3	2

At Swee Lee the total number of *Schoenobius* egg masses collected was 129 out of which 41 were parasitised.

88 not parasitised	...	68.2 per cent.
29 masses by <i>Trichogramma</i>	...	22.5 " "
4 masses by <i>Phanurus</i>	...	3.1 " "
3 masses by <i>Trichogramma</i> and <i>Phanurus</i>	...	2.3 " "
4 masses by <i>Tetrastichus</i>	...	3.1 " "
1 masses by <i>Tetrastichus</i> and <i>Trichogramma</i>	...	1.0 " "

At Bagan Serai the total number of *Schoenobius* egg masses collected was 1070, out of which 413 were parasitised as follows:—

657 masses unparasitised	...	61.4 per cent.
93 masses by <i>Trichogramma</i>	...	8.7 " "
241 masses by <i>Phanurus</i>	...	22.5 " "
69 masses by <i>Trichogramma</i> and <i>Phanurus</i>	...	6.4 " "
5 masses by <i>Tetrastichus</i>	...	0.5 " "
3 masses by <i>Tetrastichus</i> and <i>Trichogramma</i>	...	0.3 " "
2 masses by <i>Tetrastichus</i> and <i>Phanurus</i>	...	0.2 " "

The majority of the egg masses at Swee Lee were parasitised by *Trichogramma* and the majority at Bagan Serai by *Phanurus*. The highest percentage parasitism occurred both at Swee Lee and Bagan Serai in January, 50 at the former and 71 at the latter area.

Towards the end of February most of the padi plants in both the 1/6 acre at Swee Lee and Bagan Serai were dead and the collection of egg masses was confined to some of the remaining fresh plants and volunteer padi. During March, all the padi plants in the two areas were dead and the collection of egg masses was limited to volunteer padi.

Experiment IV - Light Traps.

Three light traps were set up in the Government Padi Experimental Station at Titi Serong. Ordinary kerosene-burning hurricane lanterns were used as the source of light. The moths were trapped in trays 2 feet square and 3 inches deep, containing water covered with a film of kerosene. Each trap was protected from rain by a roof constructed from nipah leaves.

Two lamps were lit for a part of the night, the third burning all night. The hours during which the lamps were kept alight were as follows:—

No. 1 — 10.00 p.m. to 6 a.m.

No. 2 — 6.30 p.m. to 10 p.m.

No. 3 — 6.30 p.m. to 10 p.m.

The records for this season were taken from June 15th, 1931, to March 31st, 1932. The above arrangement of the light was carried out from June 15th to 31st July, 1931, when only two of the lamps, which were kept alight all night from 6.30 p.m. to 6 a.m., were used.

The results obtained with each of the three species of borer are given separately below:—

Diatraea auricilia :—From the night of the 15th—16th June to the night of 29th—30th June very few moths were caught. The maximum number of males and females respectively was 4 and 5. During July no moths were obtained. In August, when only two lamps were used a few moths were obtained during the first and second week of the month. Moths were absent again from the night of 13th—14th August till the night of 18th—19th August when a male was caught and another on the night of 22nd—23rd August. During September moths appeared at the end of the first week and were absent again about the end of the month. During October no moths were caught until the third week of the month. In November very few were captured but a slight increase of the females of the species occurred at the end of the month. During December an increase in males and females occurred but the number of males decreased in the latter part of the month. In January *Diatraea* increased, the maximum number of males and females caught in one night was 89 and 102 respectively.

At the beginning of February about the same number of males and females was caught each night, but towards the end of the month a marked increase in the number of females occurred. The largest number of *Diatraea* caught in one night was 571. In March the number of males dropped and of females increased considerably. The maximum number of females caught in one night was 588, the highest number recorded during the season.

The figures below show the catch for each month :—

Period.	Males.	Females.
June 15th to 30th inclusive, 1931 ...	15	16
July ...	Nil	Nil
September ...	31	10
October ...	15	1
November ...	30	36
December ...	239	291
January — 1932 ...	601	632
February ...	629	1,883
March ...	415	3,770

The total number of moths caught from the night of June 15—16th to and including the night of March 30—31st., 1932, was males 1975 and females 6639.

Schoenobius incertellus :—The first considerable increase in the number of moths occurred in December. The total number for the month was 420 males and 105 females. During June, July, August, September, October and November very few moths were captured.

The largest number recorded during the season was 422 males caught in February and 254 females caught in March. The major difference between *Diatraea* and *Schoenobius* at light is that the females of the former and males of the latter predominated,

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The total number of moths caught in each month during the season was as follows :—

Schoenobius incertellus.

Period.	Males.	Females.
June 15th to 30th inclusive ...	19	6
July ...	Nil	Nil
August ...	3	15
September ...	50	12
October ...	15	1
November ...	31	9
December ...	420	105
January ...	377	111
February ...	422	124
March ...	31	254

The total number of *Schoenobius* moths caught during the season was 1368 males and 637 females.

Sesamia inferens :—*Sesamia* first appeared in the traps in December, 1931. From December 1931 to March, 1932, the total number caught was 92 males and 4 females.

The table below shows the number caught in each month during the season.

Sesamia inferens.

Period.	Males.	Females.
June 15th to 30th inclusive ...	Nil	Nil
July ...	Nil	Nil
August ...	Nil	Nil
September ...	Nil	Nil
October ...	Nil	Nil
November ...	Nil	Nil
December ...	5	Nil
January ...	5	Nil
February ...	42	1
March ...	40	3

These results differ considerably from those of 1930—31. In the case of *Diatraea* very few were attracted to the light before February, whereas in 1931—32 a marked increase was recorded in December and continued till the termination of this experiment at the end of March. Few *Schoenobius* moths before January 1931 were attracted but this season's result shows a large increase in December. A marked decrease was recorded in March in this season's work, but in 1930—31 the decrease was not recorded till April. It is suggested that these variations may be due to padi being planted earlier in the 1931—32

than in the 1930—31 season but no definite statement can be made at this stage especially since Mr. Pagden is of the opinion that *Diatraea* is to some extent seasonal in the Krian District as evidenced by the usually good crop obtained by early planting even when the area is adjacent to one planted later and subsequently subject to heavy attack.

SUMMARY ✓

Experiment I. - Stem Counts. ✓

About the same number of tillers was attacked in the Colonised and Uncolonised areas but the stems in the Uncolonised area contained more larvae and pupae than in the Colonised area.

Trichogramma cannot be stated to have prevented the boring of stems.

Experiment II. ✓ 1. Natural and Induced Parasitism. *Diatraea*. ✓

In the plots receiving parasites, no increase of parasitism after the liberation of parasites was recorded, but in the Uncolonised plots an increase of about 7 per cent. in natural parasitism occurred.

Schoenobius. ✓

In the Colonised plots the percentage parasitism increased by 29 per cent.

In the Uncolonised area, natural parasitism increased by 12 per cent., indicating a possible increase due to *Trichogramma* of 17 per cent: such a deduction, however, is not supported by the result obtained in the *Diatraea* collection.

Chilo.

Trichogramma is not an active parasite on the eggs of this moth. This parasite only emerged from one egg mass out of 68 collected.

2. Stem Counts.

A larger percentage of stems was bored in the Colonised than in the Uncolonised areas.

3. Harvesting.

A larger yield was obtained from the Uncolonised than from the Colonised areas.

Experiment III - Seasonal Occurrence of Borers.

1. *Diatraea*. —

Swee Lee — *Diatraea* increased at the end of November and continued during December. An increase was also recorded in March.

Bagan Serai — *Diatraea* increased towards the end of November, decreased considerably towards the end of December and increased again in February.

The increase during 1930—1931 padi season occurred in February.

Diatraea is more numerous in certain months and there would appear grounds for supposing that it may be seasonal as this result indicates that more eggs masses were collected at Bagan Serai about a month earlier than at Swee Lee.

2. *Schoenobius*.

Schoenobius was more numerous at Bagan Serai than at Swee Lee and would appear to be more prevalent at Bagan Serai a month earlier than at Swee Lee.

3. *Trichogramma*.

Trichogramma from the *Diatraea* egg masses was obtained in October at Bagan Serai and in November at Swee Lee and from *Schoenobius* in November at Bagan Serai and December at Swee Lee.

Experiment IV - Light Traps.

Moths were attracted to light traps a month earlier than in 1930—31.

It is impossible to say whether these moths are seasonal but increases seem to occur as the supply of food material increases.

Discussion.

The 1931—1932 experiments have revealed that the study of these borers is attended with endless difficulties and that considerably more work will be required before efficient measures for their control can be recommended. The results of the investigations made during the past two years indicate that *Trichogramma* cannot be considered as an effective parasite in the control of padi stem borers even when liberated in large numbers. The liberations made during the 1930—31 padi season, recorded in *Malayan Agricultural Journal*, March 1932, showed a marked increase in parasitised ova but in the case cited the total rate of liberation was 1,300,000 parasites per acre, parasites being liberated daily from the beginning of the padi season until ripening of the grain,

an impossible procedure where large areas may have to be colonised. Furthermore, it should be noted that only *Diatraea* was attacked to any extent, *Schoenobius* being nearly immune owing to the hairy covering of the egg-masses.

In the experiments recorded above an attempt was made to put the liberation of parasites on a more economic basis by liberating in smaller numbers for a short period at the first sign of an increase in borer activity, but even here, although 200,000 parasites per acre were used, the results demonstrate that in these numbers the parasite is ineffective.

THE VEGETATION OF THE RICE LANDS IN NORTH KEDAH.

BY ·

W. N. SANDS,

Principal Agricultural Officer, Kedah.

In the present paper an account is given of the vegetation, from an agricultural standpoint, in the large areas of North Kedah which have been cultivated with rice for many years. The soil of these lands has in course of time become consolidated and edaphic and other factors are fairly stable, whereas, in the more recently cleared areas, such as those that were under swamp jungle, the fields are, as a rule, soft and boggy and contain a high percentage of vegetable debris, with the result that, as cultivation proceeds, their soils and plant populations are subject to fairly rapid changes.

Description of Rice Lands.

The rice areas are situated on a large alluvial plain which follows the west coast of the State and extends from Gunong Jerai (Kedah Peak) in the south to the Perlis State boundary near Kodiang in the north. The plain has a total length of about 44 miles and a breadth of from 8 to 14 miles. The soil is usually several feet deep and consists mainly of stiff clay, but somewhat lighter clays occur in certain places.

The greater portion of the land is free of virgin or secondary jungle, but along the coast quite extensive belts of swamp jungle remain which are slowly being cleared and brought under cultivation. These areas, which generally possess good rice soil, are known as 'hutan gelam' on account of the preponderance in them of the cajuput oil tree (*Melaleuca leucodendron*, Linn.). There are, also, a few fairly large uncultivable swamps in inland places with little or no tree growth.

Throughout the plain there are numerous large and small controlled drainage canals by means of which water from small streams and rainfall is conserved and utilized on the fields and which also serve to carry off any excess of water after, and during, periods of heavy rainfall.

The waters of the two large rivers, namely, the Muda river to the south-east, and the Kedah river in the north, are not brought to the lands; there is, therefore, no large system of perennial irrigation with the result that during periods of drought, crops, the indigenous vegetation and live-stock, may suffer considerably.

Rainfall and Climate.

In Alor Star, which town is situated in the centre of the area, the average monthly rainfall, in inches, of the past ten years, 1923—32, was as under :—

January	1.86 inches	July	5.27 inches
February	1.77 "	August	9.85 "
March	5.39 "	September	11.42 "
April	8.13 "	October	12.85 "
May	10.24 "	November	7.50 "
June	8.82 "	December	6.03 "

The average annual rainfall is heavy, being 89.13 inches. The wettest months are May, August, September and October, but the incidence of the rainfall varies from season to season, so that June, November, or December, may be very wet months in particular years. In most years there is a fine, dry period, with strong north-west winds, extending from the middle or end of December to March. In March, the weather is usually showery, whilst that of April is much wetter.

Methods of Cultivating Rice Fields.

There are two methods of preparing the land for planting, namely, by ploughing, raking and rolling it, or by simply cutting down the vegetation, which had developed since the last harvest, to the surface of the soil and placing it in heaps to decay. Both systems have for their object the destruction, as far as possible, of the plant growth which has developed during the previous 4 or 5 months, and also to provide suitable conditions for planting. All operations are carried out when the fields are flooded, but not deeply. Of the two methods employed the first is more efficient in destroying grasses, sedges, and other plants, but neither effects their complete eradication.

Cultivation is usually commenced in May, if sufficient rain has fallen by that time, and is continued until planting has been completed in July, August or early September. Harvesting takes place from the end of December to about the end of February, and after harvest, the straw and a good deal of the stubble are burnt on the land. The fields at this time are, therefore, practically devoid of green vegetation, except along bunds and drains, in water-holes and low-lying places.

Following harvest the soil becomes very dry, hard and cracked and remains so until showers fall in March. Under normal circumstances therefore, there is only a period of about 4 to 5 months in which fortuitous vegetation can develop in the arable areas, and this is frequently grazed over by buffaloes and cattle with which animals the State is well stocked.

The Plant Population of the Fields Before Cultivation.

During the period which elapses from harvest to the commencement of cultivation the fields become covered with a growth of grasses, sedges, rushes and other plants, which growth varies considerably with the fertility of the soil, the level of the land and the amount of rainfall received.

The small bunds that divide up the fields into small divisions and serve to retain water on the land usually support quite a number of species. Among the grasses may be mentioned Bermuda grass (*Cynodon dactylon*, Pers), 'halia' (*Panicum repens* Linn); love-grass (*Chrysopogon aciculatus*, Trin); 'kusa-kusa' (*Echinochloa colona*, Link); 'sayap gagak' (*Paspalum Commersonii*, Lam); 'gerek telinga' (*Ischaemum aristatum* Linn); pasture grass (*Oxonopus compressus*, Beauv) and in certain places, *Apocopsis siamensis*, Camms. On broader bund, roadsides and banks, these plants together with 'lalang' (*Imperata arundinacea*, Cyr) and a useful grass with which it is commonly associated, namely, *Amphilothis glaba*, Staph, thrive well.

Other common bund plants are 'bujang semalam' (*Jussiaea suffruticosa*, Linn); 'rumput aur' (*Commelina nudiflora*, Linn) and *C. salicifolia*, Roxb; 'biu' (*Eclipta alba*, Hassk); 'gelumak susu' (*Sphacranthus africanus*, Linn) and 'lemak ketam' (*Melochia corchorifolia*, Linn). To the above list could be added several species of sedges and other plants, but the grasses only are of agricultural interest as they provide quite considerable quantities of food for live-stock during several months of the year.

In water-holes, drains and swampy places strong growing grasses and sedges form the greater part of the plant population. Here are found 'kumpai' (*Hymenachne Myuros*, Beauv), 'salit' (*Leersia hexandra*, Sw); 'padi yang' (*Oryza fatua* var *longearistata*); 'halia' (*Panicum repens*, Linn); *Charmacraphis squarrosa*, Merr and several other water-loving grasses and sedges. The dominant species found almost everywhere in these places is the robust sedge, 'menderong' (*Scirpus grossus* L.). In open water and drains there occur 'rumput ayer' (*Monochoria vaginatis* Presl); 'kangkong' (*Ipomoea reptans*, Forsk) also the water-lily (*Nymphaea stellata*, Willd) and other floating plants such as *Jussiaea repens* Linn; *Neptunia oleracea*, Low; *Limnanthemum indicum*, Thw; 'kambiang' (*Pistia stratiodes* Linn) and the water-hyacinth (*Eichornea crassipes*, Solms). With the exception of the grasses which provide a certain amount of forage, the other plants are not of much value. On the other hand, these water-holes and swampy places do form centres from which troublesome weeds and pests may spread to growing crops.

The vegetation of the areas above described is of minor importance compared with that of the cultivated fields. It has been mentioned that after the rice-crop has been harvested in the dry season, the straw and most of the stubble are burnt, and the land left almost bare. A few shoots may develop from the stubble that remains, but these are short-lived. As soon as rain falls, however, the padi which had been scattered over the ground during harvesting operations—and this is always quite considerable in amount—quickly germinates, as does the seed of other plants, such as grasses, sedges and rushes, but more particularly that of the grass 'sayap gagak' (*Paspalum Commersonii*). The rhizomes of certain grasses and sedges which have survived weeding and burning operations also start new growth. The grasses namely, 'sabut'

(*Charmaeraphis squarrosa*), 'padi yang' (*Oryza fatua* var *longe-aristata*); *Echinichola Crus-galli* and 'halia' (*Panicum repens*), together with the sedge 'menderong' (*Scirpus grossus*) may be specially named.

The more important plants are volunteer rice and the 'sayap gagak' grass. These grow very rapidly and provide, when young, good grazing for working animals especially buffaloes. 'Sayap gagak' occurs in abundance. It is an annual grass with numerous short, thick stems that lie close to the ground and which often completely cover the soil. The ripe seed of the plant can remain in a dormant condition when submerged in mud and water for 7 months or more; it then germinates freely after the first showers following dry weather, and usually completes its growth before the fields are deeply flooded. The plant is readily destroyed by ploughing and flooding, and although it is not a hydrophyte, it is one of the most useful grasses which grow in the fields after harvest. 'Sabut' (*Charmacraphis squarrosa*) is a perennial creeping Siamese grass which, until these investigations were started, had not been recorded from any part of Malaya. It has probably been in the State for several years as it is fairly widely distributed. In dry weather its stems and leaves closely resemble Bermuda grass (*Cynodon dactylon*) and may be easily mistaken for that species. It has long, thin, wiry rhizomes which root freely and send up shoots from all nodes. After the fields are flooded it produces floating stems and rather broader leaves. Owing to the plant being a hydrophyte, and also because it can survive periods of drought, it is a most difficult grass to control in the fields. 'Padi yang' (*Oryza fatua* var *longe-aristata*), is a wild rice which produces long floating stems and ears of long-awned padi. It is a fairly common plant in some areas and has most likely been introduced from Siam for growth in deep-water situations in order to provide forage for live-stock. It is, however, a very troublesome weed in cultivation. *Echinochloa Crus-galli* is a rice-like annual plant which nearly always occurs sporadically, but is not difficult to deal with. 'Halia' (*Panicum repens*) like *Charmacraphis*, always gives much trouble in weeding. It produces long deep-rooting rhizomes and narrow glaucous leaves. It can withstand dry conditions and thrive in water. Another weed-pest in lands cultivated by means of implements is the large sedge, 'menderong' (*Scirpus grossus*). This robust species produces numerous subterranean rhizomes which penetrate so deeply into the soil that they cannot be uprooted by the light native plough. It has, therefore, to be dealt with by hand. In the rice fields of the Krian district of Perak, this sedge is the chief source of supply of organic matter, but as no ploughing is done there, it is not considered to be a troublesome plant. In North Kedah, however, every effort is made to keep it under control. It has no feeding value for animals.

It will be seen, therefore, that apart from volunteer rice and 'sayap gagak', relatively few useful and harmless plants develop in the fields from harvest to planting, but these are of considerable value as green manure and for supplying food for working animals. Along drains and bunds, more species, chiefly dry land ones, occur, and these also provide limited amounts of forage.

The Weeds of the Flooded Fields.

The chief plants of the flooded fields are those mentioned above together with small sedges and rushes. In most seasons, however, the submerged species, 'lumut rumput' (*Blyxa Malayana*, Ridl) and the 'bladder-wort' (*Utricularia flexuosa*, Vahl) are present, whilst in particular years when the rainfall is heavy and fairly continuous over a period of two months or more, two other plants develop in the water to such an extent that the growth of the young rice plants is impeded; these are *Enhydris angustifolia*, Ridl and *Chara gymnophytis*, Brann. With *Utricularia* they are collectively termed 'lumut' or moss. As these submerged hydrophytes have formed the subject of a recent article by Sands (N.H.) in *Malayan Agricultural Journal*, Vol. XXI, No. 4, they need not be referred to at length here.

The Plants of Drained Rice Lands.

If land which has been cultivated with rice for many years is levelled and drained, indigenous plants, chiefly grasses and sedges, establish themselves to form rough pastures unless they are regularly mown or grazed over. Owing to the clay soil, combined with alternate periods of dry and wet conditions, the permanent pastures which are eventually formed are generally poor in useful species. It is very difficult to prevent water-logging of the surface soil of these level areas in months of heavy and frequent monsoon rainfall, except by the adoption of rather costly and elaborate systems of drainage.

Observations were made in two large areas near to Alor Star which had been reclaimed from rice and allowed to revert to pasture, these were:—

- (a) The Golf and Race Course Reserve,
- and (b) The Alor Star Aerodrome.

(a) The Golf and Race Course Reserve.

This is an enclosed area of old rice land some 95 acres in extent, which was taken over, levelled and drained sixteen years ago. Certain portions such as the race course, fairways and the greens are regularly scythed or mown. Others, chiefly under 'lalang' (*Imperata arundinacea*) are burnt annually. Besides these areas there are others which are low-lying and which are rarely interfered with in any way.

The whole reserve is surrounded and crossed by large open drains and there are, besides, numerous rubble sub-soil ones. Notwithstanding this drainage, a large proportion of the area becomes water-logged on the surface, often for many consecutive days, in the wet months of the year. In the dry season the soil becomes very dry and its surface cracked,

In the areas which are regularly mown the dominant species is the love-grass (*Chrysopogon aciculatus*, Trin.) There are also small scattered patches of the wiry, tufted grasses *Dimeria ornithopoda* Trin, 'kutu kerbau' (*Eragrostis clongata* Jacq and 'tulang belalang' (*Eragrostis tenella* R and S.). The pasture-grass (*Axonopus compressus* Beauv); the creeping 'gerek telinga' (*Ischaemum aristatum*, Linn); 'halia' (*Panicum repens*, Linn); *Paspalum longifolium* Roxb; *Apocopsis siamensis*, Comm. and young shoots of 'lalang' (*Imperata arundinacea*, Cyr) also occur. Among these grasses are small tufted sedges. The love-grass is by far the most useful pasture grass here, as it covers the ground well and withstands adverse soil conditions. Alone it provides rather poor feeding, but when associated with 'gerek telinga' and the newly discovered grass, *Apocopsis siamensis*, Camms, quite good pasturage is formed. The *Apocopsis* is rather like 'gerek telinga'; it has the same creeping habit, but narrower leaves. This Siamese grass, like *Charmacraphis squarrosa*, had not been previously recorded in Malaya, still it is quite common in the neighbourhood of Alor Star and thrives well under local conditions.

In uncut fairly well-drained places 'lalang' (*Imperata arundinacea*), although burnt periodically, forms dense masses of growth to the exclusion of other species, still in patches where the growth of it is thin, 'gerek telinga', 'halia' and *Paspalum longifolium*, Roxb, are able to develop. These grasses together with young 'lalang' are regularly cut for fodder in dry weather. In the low-lying places which are not well drained, such as those previously described, and rarely touched, there is a large number of sedges with patches of 'halia', 'gerek telinga', *Dimeria ornithopoda*, *Sacciolepis turgida* Ridl, love-grass and a few other plants. The grasses occur mostly in tufts so that the soil is not closely covered by vegetation as in the better-drained areas due, of course, to the rather prolonged flooding which is periodically experienced.

(b) The Alor Star Aerodrome.

This area is situated about 7 miles north-east of Alor Star. About 2 years ago approximately 200 acres of rice-land was acquired for use as an aerodrome. The land was levelled and drained. The drainage consisted of a large open ditch surrounding the area into which were led numerous subsoil drains. The surface soil was rather lighter than that of the Golf and Race Course reserve. No special planting of grass was undertaken so that the vegetation which is now found on the site has been established by natural means. The chief problem which has confronted the aerodrome authorities has been the quick disposal of the water which accumulated on the surface of the soil to a depth of 2 to 4 inches after heavy rain. This water-logging also impeded the growth of pasture grasses. The vegetation is cut over at regular intervals.

Unlike the older established golf course area, 'lalang' and love-grass are not present to any extent, but the wiry tufted grasses, 'kutu kerbau' (*Eragrostis elongata*), 'tulang belalang' (*E. tenella*) and *Dimeria ornithopoda* are common. These with *Paspalum longifolium*, 'halia' (*Panicum repens*) and 'gercek telinga' (*Ischaemum aristatum*) are the chief grasses, but as expected, under the conditions described, small sedges abound.

From a pasturage point of view the most useful grass is 'gercek telinga' (*Ischaemum aristatum*) as it covers the soil well where it grows, and is much liked by grazing animals. Leguminous plants are comparatively rare; however, the hardy little 'omba omba' (*Desmodium heterophyllum* D.C.) and a rather woody straggling species *Geissasapis cristata* W. and A. which resembles a *Desmodium*, are present.

The adverse effects of dry and wet conditions, but more particularly the latter, on the character of the plant population of the permanent pastures is clearly seen here as elsewhere.

General Remarks Concerning Pastures.

The amelioration of the local soil conditions by effective drainage in order to obtain better pasturage is difficult to accomplish even in unbunded areas, still, studies and trials should be made, of selected indigenous grasses that are known to thrive under local conditions. Some of these grasses have already been mentioned. It is possible, also, that certain exotic grasses, such as carpet grass (*Axonopus compressus* var.) and Australian blue couch (*Digitaria didactyla*) might prove of value, nevertheless, unless an introduced species can compete successfully with local grasses when associated with them, it is not likely to prove of permanent value. That this is possible is shown by the natural spread of the useful Siamese grass, *Apocopsis siamensis*. On the other hand, care must be exercised that plants which may become troublesome weeds are not introduced and allowed to escape, such as has apparently been the case with the grass *Chamaeraphis squarrosa* and the wild-rice, *Oryza fatua* var *longe-aristata*, of the rice fields.

Further, it remains to be demonstrated whether it will be sound agricultural practice to allow undrained portions of rice-land with open bunds to remain temporarily uncultivated for one or two seasons in order that indigenous plants may develop on them for the purpose of improving the physical and chemical properties of the soil and to provide grazing for live-stock.

Acknowledgment.

The writer is much indebted to the Assistant Principal Agricultural Officer (H.H. Tunku Yacob) for his valuable assistance in the investigations and also

he desires to acknowledge the most useful help rendered by the Director of the Botanic Gardens, Singapore (Mr. R. E. Holtum) in the identification of several of the grasses. He also appreciates the loan of herbarium specimens by the Botanical Division of the Department of Agriculture, S.S. and F.M.S., for identification purposes.

Summary.

- (a) An account is given of the rice lands in North Kedah together with a description of the soil, climatic conditions and methods of cultivation.
 - (b) The indigenous plants of the fields in different situations are described.
 - (c) The chief weeds of the cultivated areas are named and their characteristics discussed.
 - (d) A description is given of the plant associations of two large areas of pasture land which had been reclaimed from rice for 16 years and 2 years respectively.
 - (e) The possibility of improving local pastures by the selection of useful indigenous species and the introduction of exotic ones is referred to.
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Miscellaneous Article.

CONDITIONS ON SMALL RUBBER HOLDINGS IN MALAYA.

2nd Quarter 1933.

*Prepared by the Economics Branch of the Department of Agriculture,
S.S. and F.M.S. in collaboration with the Field Branch of the
Department of Agriculture.*

Rainfall.

In April, the rainfall approximated to normal throughout the Peninsula being somewhat heavier in the inland regions than on the East Coast. In May, rainfall decreased after the middle of the month in most areas north of Krian : from there southwards however, the precipitation was heavy throughout the month being somewhat above normal in some districts. Rainfall approximated to normal in Malacca, Singapore and East Pahang..

As usual June was a fairly dry month throughout the country, Malacca being the only place where the rainfall showed any appreciable increase over the average figure for this month.

Prices.

Table I, included in this article, shows the range of prices among local dealers for small-holders' rubber over numerous centres throughout the country where various factors, such as transport and competition, necessarily affect the prices paid to the producer. The table includes the average monthly Singapore prices for standard sheet and the prices quoted at the end of the month by the large dealers for small-holders' rubber, for the purpose of comparison. All quotations are given in Straits dollars and cents for the price per picul (133½ lbs.).

The following table shows the trend of average prices per picul ruling in Singapore for Kampong rubber during the first six months of 1933.

		Average price for Smoked Sheet \$	Average price for Unsmoked Sheet \$	Average price for Scrap \$
January	...	8/-	7/-	3/20
February	...	7/50	6/70	2/40
March	...	7/60	6/80	2/50
April	...	7/80	6/80	2/70
May	...	11/80	11/-	5/-
June	...	13/50	12/25	5/-

TABLE I.

Rubber Prices [in Straits dollars per picul (133½ lbs.)]

2nd Quarter 1933.

	Singapore standard sheet Average	Singapore for small holders at end of month	Penang for small holders	Perak	Selangor	Negri Sembilan	Pahang	Malacca	Province Wellesley	Kedah	Johore
Smoked sheet.	9.22	7.80	—	6.30-9.50	6.80-9.50	7-9.30	6.60-9.30	6-9.20	6-9.35	6.50-11.40	5.50-9.50
Unsmoked sheet.		6.80	6.20-8.60	4.50-8	5.50-8.10	5-8.30	5.50-8.40	5.50-8	6-8.50	5.50-8.50	4-9
Scrap		2.70	2-3.30	1-3.50	1.50-3.50	1-3	1.50-3.30	1.50-3.50	2-3.50	2.20-3.50	1.30-4
Smoked sheet	11.10	11.80	—	8-12	9-13	10-12	9-11.60	8-12	8.50-12.25	10-11.60	7.85-11.60
Unsmoked sheet		11	8.60-10.70	6.50-10.80	8-11.50	6-11	8-10.20	6.50-11	7-11.25	8.25-10.60	6.85-11
Scrap		5	4-5.10	1.50-4.50	1.80-5	2-4.50	2-4.50	2-4	2-5.50	2.90-4.40	2-5.50
Smoked sheet.	14.99	13.50	—	8-14.50	9.75-15.25	7-15	10-15.50	13-14.50	11-13.60	11-14.70	10.30-15
Unsmoked sheet.		12.25	11.20-14	5.80-13.50	9.50-13.50	8-12.60	8-14	11-13.50	9.10-14	8.70-12.50	7-13.50
Scrap		5	4.70-6.60	1-6	2-6	2-5	2-6.50	2.50-6	3.30-6	3.10-6	2-5.50

Table II
Estimated Acreage of Tappable Rubber which was out of Tapping on Holdings of less than 100 Acres, during June, 1933.

PERAK				SELANGOR				NEGRI SEMBILAN				PAHANG			
District	Total Tappable area	Total untapped area	Percentage	District	Total Tappable area	Total untapped area	Percentage	District	Total Tappable area	Total untapped area	Percentage	District	Total Tappable area	Total untapped area	Percentage
Batang Padang	37,288	4,475	12	Klang	18,879	4,530	24	Seremban	19,241	5,772	30	Raub	7,361	442	6
Kinta	34,180	1,367	4	Kuala Langat	29,263	2,634	9	Tampin	17,947	1,615	9	Kuala Lipis	15,951	4,307	27
Kuala Kangsar	43,485	2,174	5	Ulu Langat	38,867	3,887	10	Kuala Pilah	17,470	3,494	20	Bentong	13,600	2,992	22
Upper Perak	13,774	3,306	24	Ulu Selangor	30,632	3,676	12	Jekebu	6,270	439	7	Other Districts	31,223	5,620	18
Larut & Selama	51,407	10,281	20	Kuala Lumpur	21,174			Port Dickson	10,653	2,130	20				
Krian	9,751	585	6	Kuala Selangor	9,379	3,682†	12†								
Lower Perak	47,937	2,397*	5*												
	237,822	24,585	10		148,194	18,409	12		71,581	13,450	19		68,135	13,361	20
MALACCA				PENANG & P. WELLESLEY				SINGAPORE				The percentage of areas out of tapping in March, 1933, was as follows :—Perak 25, Selangor 20, the Negri Sembilan 30, Pahang 39, Malacca 37, Penang and Province Wellesley 40, Singapore 62. * Estimated from same percentage as shown in Kuala Kangsar District. † Estimated from mean percentage for remainder of State.			
District	Total Tappable area	Total untapped area	Percentage	District	Total Tappable area	Total untapped area	Percentage	District	Total Tappable area	Total untapped area	Percentage				
Central	17,687	5,837	33	North	3,241	421	13	Singapore	12,781	5,751	45				
Alor Gajah	31,387	8,474	27	Central	7,067	424	6								
Jasin	24,97	1,748	7	South	6,149	244	3								
				Dindings	7,279	2,620	36								
				Penang	11,114	2,223	20								
	74,045	16,959	22			36,850	5,932	16		12,781	5,751	45			

The percentage of areas out of tapping in March, 1933, was as follows:—Perak 25, Selangor 20, the Negri Sembilan 30, Pahang 39, Malacca 37, Penang and Province Wellesley 40, Singapore 62.

* Estimated from same percentage as shown in Kuala Kangsar District.

† Estimated from mean percentage for remainder of State.

Figures of total tappable area differ from those shown in the report for the preceding quarter in that a total of 17,911 acres, being the area planted in 1927, has now been included.

Tapping.

Reports throughout the country indicate that there has been a considerable increase in the areas tapped among small holdings consequent on the rise in price of rubber during the quarter. In Penang and Province Wellesley it is said that somewhat severe tapping systems are in vogue among small-holders while reports from the Negri Sembilan state that newly opened tapping cuts have been observed in a few cases at a height of 6 feet.

Owing to the increased number of holdings in tapping in Singapore, the shortage of labour consequent on repatriation of a large number of Chinese coolies in the past is now being felt. In Kedah, it is anticipated, if further holdings are brought into tapping, there will be a scarcity of labour available for padi cultivation.

The bagi-dua system of tapping is increasing in popularity during the padi planting season.

Areas out of Tapping on Small Holdings.

The method of estimating the area untapped among small holdings by means of counting the number of such holdings along the sides of main roads was again employed at the end of this quarter.

Table II shows the result of this computation as applied to the known area of tappable rubber, 1927 planting and earlier.

It will be seen that the recent rise in price of the commodity has had a very definite effect on the areas tapped throughout the Straits Settlements and the Federated Malay States; the decrease in the untapped areas recorded are as follows:

The total area of tappable rubber on estates of less than 100 acres which was untapped in the Federated Malay States in June 1933 is estimated on the foregoing system as amounting to approximately 56,355 acres, as compared with 133,000 acres in March of this year or a decrease of 76,645 acres.

The total area untapped in the Straits Settlements in June is estimated to be 27,742 acres as compared with 49,000 in March 1933, or a decrease of 21,258 acres.

Diseases.

Mouldy Rot.—The rainfall in April and May was the cause of a general recrudescence of mouldy rot in most infected areas with the exception of Selangor and Perak North, where, in spite of wet weather, increase in the incidence of this disease was very slight. The dry weather in June effected, to a great extent, the normal natural control.

Oidium Heveae.—This disease is reported to have been prevalent in both the Negri Sembilan and in parts of North Johore; no noticeable damage caused by *Oidium* has, however, been observed.

Pink Disease.—Cases of Pink disease have been observed in the mukims of Sungei Jambu and Ijoh in Kuala Selangor and in the small areas of the Segamat district of Johore. Satisfactory measures for its treatment have been carried out.

Root Disease.—The only report which has been received in this connection is one from the Selama District of Perak where, it is stated, increased attention is being paid to control measures on small-holdings.

Grades of Rubber Made.

Figures of the percentages of the various grades of rubber produced, where these have been recorded, are as follows :—

Perak : Larut and Matang :—(figures from 12 dealers) smoked sheet 15, unsmoked sheet 60, scrap 14, lump 11.

Selama :—smoked sheet 80, unsmoked sheet 16, lump and scrap 4.

Kuala Kangsar :—(6 dealers) smoked sheet 35; unsmoked sheet 36, scrap 29.

Selangor : Ulu Selangor District only :—smoked sheet 89, unsmoked nil, scrap and lump 11.

Negri Sembilan : Rembau, Kuala Pilah and Jelebu :—(7 dealers) smoked sheet 12, unsmoked 66, scrap 22.

Malacca : all Districts (32 dealers) : smoked sheet 20, unsmoked sheet 63, scrap 17.

Slab is still produced in moderate quantities in the Krian, Larut and Matang district of Perak; its production elsewhere is insignificant.

Prices obtained for this grade of rubber in the Krian district ranged from \$2 to \$3.50 per picul, and in Larut and Selama from \$3.50 to \$5.50 per picul throughout the period under review.

Tendency to Abandon Rubber Cultivation for Alternatives.

With the exception of Malacca and Negri Sembilan, where further small areas of rubber have been cut down to make way for the planting of food crops, this practice, generally, appears to have entirely ceased.

General.

The improvement in the rubber market has caused a corresponding renewal of interest in the cultivation of the crop, with the effect that in parts of Perak, Pahang and Johore the clearing of undergrowth has been carried out on a number of small holdings.

A report from Johore also states that many holdings have been newly brought into tapping. In the Batang Padang district of Perak an area of 140 acres of young rubber has been newly opened during the quarter.

The estimated production of rubber by estates of less than 100 acres in area for the first six months of 1933, is shewn in Table III.

Table III.

Estimated Production of Rubber by Estates of less than 100 acres in area during the period January to June, 1933.

1933.		F.M.S.	S.S.	U.M.S.	Total Malaya.
January	...	8,180	2,199	5,727	16,106
February	...	6,232	1,592	4,979	12,813
March	...	7,441	1,948	5,447	14,836
April	...	7,271	1,749	5,876	14,896
May	...	9,331	2,245	6,825	18,401
June	...	10,192	2,536	6,274	19,002

Abstract.

INDUSTRIAL USES OF RUBBER LATEX.*

It is well known that although travellers of the 16th century recorded the fact that South American natives produced various rubber or rubbered articles with the aid of latex, rubber manufacture in civilized countries was originally based on the use of dry rubber.

The alternative method of handling rubber for manufacturing purposes at that time was by forming a solution in a suitable solvent such as turpentine and to use this for water proofing and similar purposes.

It is easy to appreciate therefore, that the advantages of latex as a form of rubber for manufacturing purposes must frequently have been entertained by rubber manufacturers. Thomas Hancock himself in 1824 tried rubber latex for converting cheap fibrous material into an artificial leather; and he filed a patent for the process. It is of importance to note that this process actually preceded an alternative one patented by him in 1825 with the same aim, but using rubber solution. Unfortunately this latex process, together with other latex processes of Hancock for the impregnation and coating of ropes and cordage patented in 1825, and for proofing with latex patented in 1830, experienced an effective check through the inability to obtain substantial supplies of rubber latex.

Thomas Hancock was convinced of the practicabilities of latex transport, but was unfortunate in two respects. The small quantities of latex which he secured for his small-scale experiments appear to have been wrongly described to him as Hevea latex. Consequently when he appointed an Agent in Tampico to export Hevea latex in bulk, the deliveries of the much less stable Hevea latex arrived repeatedly in a coagulated condition and necessitated abandonment of his latex processes. Also only at the time of the writing of his memoirs many years later was he in a position to record the fact that ammonia had been found to be an effective preservative for latex, this discovery having been made about 1853.

The number of patents for latex processes must now reach several thousands. Somewhat surprisingly the reduction in the price of raw rubber of recent years has not been altogether favourable to the adoption of latex processes. A reason for this is that the small premium on the price of latex rubber for special handling and additional transport charges becomes a much greater percentage of the cost of raw rubber when the latter is near 2d. a lb. than when it is 2s. per lb.

On the other hand however, the reduction in the cost of raw rubber has increased the advantages of latex for purposes which cannot well be served by ordinary rubber and where latex has to compete primarily with non-rubber materials.

* Abstracted from the Journal of the Society of Chemical Industry, Vol. 52, No. 19, May 12th, 1933.

Technical Advantages.

The main advantages of latex are as follows:—

1. The rubber is available in a fluid condition without the cost and ill-effects of mastication. The latex is easily used for purposes such as spreading or soaking; further it can be compounded without the need for heavy machinery involved in ordinary rubber manufacture.
2. Latex contains a much higher proportion of rubber than rubber solutions of equivalent viscosity. The proportion of volatile medium to be removed is therefore considerably less.
3. Not only is the cost of the rubber solvent eliminated, but the fire risk and health hazards of the common solvents are obviated.
4. Latex by induced coagulation readily yields solid rubber (admittedly wet) when required, whereas solutions normally have to be evaporated more or less completely. Articles can therefore be removed at an early stage from formers, moulds, etc., permitting the rapid return of these to the cycle of operations.
5. On account of the avoidance of the development of heat which arises in the milling of raw rubber, it is possible to use freely, the most powerful accelerations of vulcanization in latex-compounding without fear of trouble from scorching or premature vulcanization. The low temperature of eventual vulcanization permits the use of bright organic pigments which would be discoloured in ordinary heat vulcanization.
6. The latex rubber products normally contain a full proportion of the natural anti-oxidant constituents of the latex and so *ceteris paribus* show better ageing qualities in addition to the greater mechanical strength arising from the unworked condition of the rubber.

Features of latex constituting possible disadvantages are:—

1. The need of a small proportion of some form of preservative or stabilizing agent, e.g. 0.5% of ammonia or 1% of potassium hydroxide.
2. The need for removal of water at some stage of manufacture.
3. The lower stability relative to rubber solutions, for example for storage. On the other hand the lower stability is a distinct advantage for some operations.
4. The incorporation of reinforcing agents, the full effect of the latter is at present more difficult than with dry rubber.

Methods of Use.

The methods by which latex may be used in manufacture fall generally within the following group of processes: spreading, soaking, spraying, dipping, electrophoresis, gelling, frothing, flocculation, crumbing and moulding. These terms are used in a wide sense, for example, spreading and dipping cover also such uses as the application of latex either as an adhesive for assembling in boot and shoe manufacture or as a bonding agent for abrasive and other materials.

Dipping Process. The principle of this process can be applied in a variety of ways. A plain dipping process can be used for the production of such articles as sacs for fountain pens and other purposes, tobacco pouches, rubber shoes, teats, surgeons' gloves etc. The dipping process can be used with ordinary latex (which customarily will have been compounded), but in order to reduce the number of immersions to build up an article of the necessary stoutness of wall, latex of increased viscosity and also increased concentration is to be preferred. Vulcanization can be effected during the drying or subsequently.

Filtration has been commercially applied in United States of America as a method for the production of motor tubes by immersing a perforated mandrel coated with superposed layers of fabric and cohesive wet powder such as clay in compounded latex; the serum passes through to the interior of the mandrel which is under reduced pressure, and a compact coating of wet compounded rubber gradually forms on the outer surface.

Spreading, which may be considered as a special case of a dipping process is to-day applied in many different ways, and in some directions on a very large scale for manufacturing purposes. Large quantities of latex variously compounded are used as or in adhesive or stiffening material in the manufacture of ordinary shoes (in preparing constructional parts and in marking cutting blocks), the consumption in this direction in 1930 being equivalent to 8,000,000 lb. of rubber. Large quantities are also used for the sealing of millions of cans. The seam in the side of the can and between the side and the base being filled with a core of rubber composition which is applied in the form of a latex paste. Latex is also used on a large scale for proofing textiles of all kinds, *e.g.* for rain coats and for producing spread rubber sheet.

Horse hair or similar fibre for upholstery is treated in its final expanded condition with compounded latex so that after drying and vulcanization, the relative position of the individual strands is fixed giving increased resilience and permanence of shape. A mixture with gelatin or with gelatin and glycerol has been applied to reduce the permeability and consequent leakage of gas bags for air ships and of inner tubes for motor tyres.

One of the early suggestions in the latex "renaissance" was that of F. Kaye in 1920 for its use as a sizing material in paper manufacture. Although this suggestion has not been adopted as widely as seemed likely at first, it contained the germ of the idea for the use of latex in bonding fibrous materials generally. To-day, latex is used largely as a binding agent *e.g.* for bonding abrasives, and to convert leather dust or disintegrated fibre into artificial leather, to consolidate crumbed rubber waste into various products and, mixed with emulsified wax, to proof cork lids and cardboard containers. Large-scale experiments are in progress in different parts of the world on its application as a binding material with or without cement for road construction and surfacing.

In this direction a mixture of stabilized latex with cement and with or without other fillers (including emulsified bitumens) is of especial promise. Such

mixture can also be used for the protection of the inner surface of concrete lined, or of wood or metal, tanks.

Moulding.—It is possible of course to use latex indirectly for moulding purposes by conversion either into a dry rubber mixing or into a dry crumb, the latter being possible for example, by a suitably modified "latex precipitate" process, and then to produce shaped articles either by an ordinary rubber moulding operation or, in the case of crumb, by shaping in a similar type of mould to that used for synthetic resin moulding powders. The articles thus formed can be either of the soft rubber type or ebonite type according to requirements, the main difference being in the proportion of sulphur employed for vulcanization. Moulding of latex by gelation or coagulation to a continuous solid mass in a shaped cavity has two distinct disadvantages, namely, the slowness of complete drying of a wet coagulum of substantial dimensions and the shrinkage which occurs during drying of a coagulum of soft rubber. These disadvantages, however, are obviated and important advantages gained in at least two special cases of this type of moulding. If the latex containing sufficient sulphur is vulcanized to the condition of ebonite in circumstances substantially preventing the loss of the entrained water, the resulting ebonite retains the dimensions of the mould, the water being very finely distributed throughout its mass. On drying, a light brown microporous ebonite is obtained, the pale colour being due to the discontinuity of the surface; pure ebonite dust also is brown. To the naked eye such ebonite has a smooth surface; it can be polished.

After adding a small proportion of a frothing agent such as an alkali soap to compounded latex it is possible to beat this into a froth which by the addition of coagulant with a delayed action, *e.g.* an aqueous suspension of sodium silicofluoride, can be caused to set or gel after pouring into moulds. The resulting gel constitutes a wet unvulcanized rubber sponge of remarkable uniformity of texture. After vulcanizing the ultra accelerated froth gel by immersion of the filled moulds in a bath of hot water the serum and additional water can be removed by squeezing or centrifuging, followed by drying which occurs rapidly. In this way it is possible to produce as single units sponge rubber cushions, arm-rests, back rests, seats, "squabs", etc. or mattresses of any desired shape, as well as simpler small articles of all kinds, such as household sponges, heel supports, etc. This new method for making rubber sponge is one of the striking developments in the application of latex.

The frothed latex can also be used in other ways, *e.g.*, for dipping purposes, so as to produce articles with a soft sponge-rubber covering; it can also be spread, for example, to form a backing for carpets to provide increased softness and resilience. Another striking application is in the preparation of moulds for the production of ornamental cement castings such as are popular in gardens. The pliability of the sponge enables the removal of castings with undercut portions such as are difficult to obtain with any other type of mould. The frothed latex is cast in the first place to produce the necessary matrix and after vulcanization and drying is ready for use.

Application of Latex to the Protection of Metals etc.

In many of the above processes it will be seen that the latex is deposited initially on a shaped former from which it is subsequently removed. If desired it is also possible to secure the latex in position so as to impart protection of the under-surface against corrosion by the atmosphere or chemical agents, and for this end latex has obvious advantages over rubber sheet which can be applied only to geometrically simple surfaces. If the protective film is to be of ebonite mere vulcanization to the hard condition alone may impart sufficient firmness of adhesion particularly if the under-surface is of copper or has been copper coated. For the ultimate firm attachment of the latex deposit to metals special compounding ingredients, *e.g.* haemoglobin can be helpful, but generally it is advisable to apply a preliminary film of adhesive capable of providing a strong bond between the metal and the rubber.

In the above discussion of the industrial uses of rubber latex reference has been made particularly to natural latex and its modifications. It must be remembered however that artificial "latex" can be produced by the dispersion of rubber (new or even "reclaimed") and that similar processes can be applied to artificial latex and to the natural product.

Eventually for certain purposes it may prove economical to ship dry rubber from the plantations with saving in transport costs and to emulsify the product in the home factory to give "latex" of the desired degree of alkalinity and stability. An obvious disadvantage is that the rubber during and possibly also before the emulsification or dispersion process would necessarily be submitted to some degree of milling or mastication with impairment of the strength of the latex rubber. However, a maximum of tensile strength is not always the main requisite.

At one time there was a tendency for prospective users of latex to follow the lines of the ordinary methods of rubber manufacture; it was, for example, frequently suggested as sufficient advantage to mix the latex (either containing its natural proportion of rubber or in a concentrated form) with compounding ingredients of the standard type and then to convert the mixture directly to an unshaped condition for concurrent moulding and vulcanizing by existing works processes. In the light of experience, however, two distinct fields of manufacture can now be discerned for one of which dry rubber still has economic advantages, while latex offers attractive possibilities in the other. An outstanding feature of latex is that it renders possible new lines of manufacture and new methods for which ordinary rubber is unsuitable. Some evidence of this has been indicated in the foregoing. Latex indeed is finding application on a very considerable scale in industries which in the past were regarded as quite outside the rubber industry. It is always unsafe to prophesy, but there is a distinct likelihood that the most important lines of development of latex manufactures will be supplementary to rather than competitive with the old-established "heavy" rubber industry.

Departmental.

FROM THE DISTRICTS.

The Weather.

The weather during the month showed no marked departure from the normal, being moderately dry throughout the Peninsula except for the coast of Malacca and Negri Sembilan, where precipitation showed the increase which generally occurs in July over this restricted area.

In general the rainfall was slightly in excess of the average for July in North Perak, Negri Sembilan and Pahang.

Remarks on Crops.

Rubber. The highest and lowest prices in dollars and cents per pikul recorded during the month for small-holders rubber were:—Smoked Sheet \$10 to \$20; Unsmoked Sheet \$7 to \$19; Scrap \$2 to \$8. The average Singapore price for small-holders rubber is not to hand for comparison but Penang prices for Unsmoked Sheet ranged from \$12 to \$18.40 as compared with a range for June of from \$11.20 to \$14.

Reports record a very definite increase in tapping generally throughout the country as the result of the continued rise in price of the commodity. The tendency towards clearing undergrowth from small holdings reported last month has become more pronounced and is general everywhere.

Padi. The price at the Government Rice Mill has risen slightly to \$1.70 a pikul for padi. Activities in preparation of land and sowing of the new crop is reported from the important padi areas of Kedah, Province Wellesley and Krian. In Negri Sembilan, transplanting is practically completed except for Kuala Pilah district whilst in Malacca transplanting is in progress in the Jasin and Alor Gajah districts and the preparation of land is well forward in the coast mukims. In Kelantan, planting of the deep alors is almost complete and nurseries are being established in other localities. In this State the planting of dry padi became general towards the end of the month when favourable weather for the operation was experienced. The planted crop in Selangor, Pahang and the major portion of Negri Sembilan is reported to be making good progress.

In parts of Larut and Kuala Kangsar districts of Perak, and the Kuala Pilah districts of Negri Sembilan, padi cultivation operations are suffering some delay from rival claims on the time of the cultivator provided by a ripening fruit crop and the rise in the price of rubber, which has had the effect of inducing increased interest in the rubber crop at the expense of the padi crop.

The attempt at the production of a short inter-season padi crop at Sri Menanti in Negri Sembilan is not proving very successful owing to lack of

interest by the cultivators concerned, who appear to have entered into the project in a very half hearted manner. Since being planted, the crop has been almost entirely neglected.

Coconuts and Copra. A report to hand from the Agricultural Field Officer, Selangor, states that at present some 7,750 pikuls of copra are being turned out monthly from small-holders kilns in Selangor which represents about 30 per cent. of the entire output of copra from the small holdings of the State. Of the amount mentioned about 1,000 pikuls is good quality copra of or above average estate quality.

Although developments are not on such a large scale elsewhere, encouraging reports are to be hand of real progress in Province Wellesley, where four out of five approved pattern kilns, operated by small-holders, are regularly turning out copra of average estate quality and another kiln is being erected.

The venture at Temerloh is proving a success and copra of average estate quality is being produced. This has encouraged other small-holders to commence the erection of a second kiln.

Progress in Bagan Datoh district of Perak is slow. The one fairly large brick kiln is producing a good quality article, but the work of erecting further kilns has made little further advance. In the class for small-holders copra at the Kuala Lumpur Exhibition the first prize was won by one of the improved kilns in Selangor and the second by the kiln at Temerloh.

Tobacco. A recent attempt at the Singapore Agricultural Station to flue cure virginian leaf in a manner that will produce yellow cigarette tobacco has been partially successful. A proportion of the cured leaf is of a pleasing colour and cigarettes were prepared from it and exhibited at the Departmental Exhibit at Kuala Lumpur M.A.H.A. Show.

During the month 120 pikuls of cured leaf prepared from tobacco grown in Province Wellesley was sold in Penang. In this island an increase in price has led vegetable gardeners again to exhibit interest in the crop as a rotation.

In Perak, there are some six acres under the crop at Selama and several scattered small areas in Kuala Kangsar district, but the main tobacco area is in the vicinity of Chemor where it is estimated there are some 300 acres. Elsewhere in South Perak some 150 acres are under this crop.

Prices for cured leaf in Penang are from \$35 to \$40 a pikul: in Taiping \$40, whilst at Bidor as much as \$58 was paid during the month for first grade cured leaf.

Agricultural Stations.

Tobacco is being harvested and cured at Bukit Mertajam Station. The varieties under trial are Local, Deli, Burmese, Havana and Thattayou. At

Kuala Kangsar Station, a fresh planting of tobacco has just been made. In Negri Sembilan, further progress has been made in improvements to Rembau Station and the layout of the Kuala Pilah Station.

Padi Stations and Test Plots.

At Titi Serong, the second transplanting of 7—7½ months varieties was completed and the nurseries of short term padi sown. At Pulau Gadong, short season varieties were sown and satisfactory progress was made with cultivation preparatory to planting. The programme for the mechanical cultivation trials was unavoidably delayed owing to trouble experienced with the tractor. Work is well forward on all the Test Plots.

DEPARTMENTAL NOTES.

Visits and Tours.

The Director of Agriculture, Dr. H. A. Tempany, C.B.E., visited Singapore on July 27th. and attended a conference with representatives of the Pineapple Packers Association held for the purpose of discussing certain questions relating to the improvement of the pineapple industry in Malaya. The Director also had interviews with the Hon'ble the Colonial Secretary and other Officials.

The Chief Field Officer, Mr. F. Birkinshaw, visited Pahang West at the end of June and inspected the progress of the Agricultural Stations. He also visited Cameron Highlands, accompanied by the Senior Assistant Agriculturist, Mr. J. N. Milsum, from July 18th. to 21st., and inspected the Experiment Station at Tanah Rata.

Mr. R. A. Altson, Assistant Mycologist, visited Pahang on June 26th. in connection with oil palm diseases.

The Acting Senior Agricultural Officer, Mr. F. R. Mason, made a tour of inspection in Perak Central and South from 10th to 15th July.

Agricultural Advisory Committee.

A meeting of the Agricultural Advisory Committee was held at the Head Office of the Department of Agriculture, Kuala Lumpur, on June 13th.

The Chairman, Dr. H. A. Tempany, C.B.E., on behalf of the meeting, expressed a welcome to the Hon'ble The Undang of Rembau and tendered the felicitations of the Committee on the honour recently conferred on him.

At the meeting, questions relating to copra and coconut research were discussed and the members were informed of the arrangements which have been made to provide for the continuation of research on copra.

Other matters discussed included the following :—

Supply of disinfectants to small-holders for the control of mouldy-rot disease of rubber trees; home-garden competitions; Tea on Cameron Highlands; the encouragement of poultry keeping by small-holders.

With regard to the latter the meeting was informed of the appointment of Mr. W. H. Barnes as poultry officer for Selangor and Negri Sembilan.

In connection with the Malayan tea industry, it was announced that an exhibit of tea from Cameron Highlands would be prepared and displayed at the Malayan Agri-Horticultural Association's Show in August, and that the market reports on the samples of this tea would then be announced.

Staff Changes and Leave.

Dr. H. W. Jack, M.B.E., has been appointed to act as Chief Research Officer with effect from June 15th. 1933.

Mr. J. H. Dennett has been appointed acting Plant Physiologist with effect from June 15th 1933.

Mr. N. C. E. Miller has been appointed acting Government Entomologist with effect from June 24th. 1933.

Mr. B. A. Lowe has been seconded to Johore for duty as Agricultural Officer, Johore North, as from June 12th. 1933.

Mr. V. R. Greenstreet, Assistant Agricultural Chemist, has been granted leave of absence with full salary, prior to retirement, for 4 months and 28 days from June 30th. 1933.

AGRICULTURAL SHOW IN KELANTAN.

A successful agricultural show was held at Peringat, Kelantan, on June 30th, 1933. The show was the first of its kind to be held in Kelantan, and it attracted a large number of exhibitors and visitors.

The wet padi and rice classes were well supported and the winning copra exhibits were of a surprisingly high standard. Other produce exhibited included rubber, a varied collection of fruits, vegetables, coconuts and coconut oil. The vegetable classes were poor, but in view of the long drought this was to be expected.

The Department of Agriculture, as represented by the Principal Agricultural Officer, Kelantan, Mr. J. A. Craig, staged exhibits illustrating the results of experiments conducted in connection with manuring and varietal trials of padi, and methods of kiln drying of copra. Demonstrations and lectures were given on these two crops, along with demonstrations on plant propagation by budding, grafting, and the etiolation method.

The Department of Irrigation erected two simple and inexpensive water lifts, operated by bullocks, and demonstrated to an interested audience the use of these lifts in irrigating padi land.

The section devoted to home crafts was also well supported and included exhibits of basket and rafia work, embroidery and crochet, and hand made neckties.

In thanking all those who had helped to make the exhibition a success the Acting British Adviser, Mr. A. C. Baker, M.C.S. expressed the hope that the high standard reached by some of the copra, rubber and padi exhibits would act as an incentive to real efforts in improving the quality of Kelantan produce.

Statistical.

MARKET PRICES

July 1933.

Rubber.—The market price for rubber rose considerably during July, opening at 11 3/16 cents per lb. for Spot loose in Singapore and closing at 12 11/16. The average price for the month was 12 11/16 cents per lb. in Singapore, 3½ pence in London and 7½ cents Gold in New York as compared with 10 15/16 cents, 3½ pence and 6 cents Gold respectively in June.

Palm Oil.—The course of the English market during July on a basis of 18 per cent. f.f.a., c.i.f. Liverpool was as follows:—July 1st. £17 per ton; 10th. July, £17; 17th. £17; 29th £17 5s. the market for the month being a steady one. Prices in the U.S.A. landed weight per pound in bulk c.i.f. New York/Philadelphia were 3.40 cents Gold on the 1st. July; 3.50 cents Gold on the 10th; 3.75 cents Gold on the 17th. and 3.70 cents Gold on the 29th. July.

The price of palm kernels Fair Average Malayan Quality c.i.f. landed weight on the Continent fell from shillings 9/- per cwt. on the 1st. to shillings 8/6 per cwt. on the 29th.

Copra.—There was a slight fall in price from the 10th. until the 17th. when the market steadied. The highest Singapore price for Sundried during July was \$4.10 per picul on the 3rd., the average price being \$3.97 per picul as compared with \$4.13 during June. The mixed quality averaged \$3.37 per picul as compared with \$3.74 in June.

Coffee.—During the month the price at Singapore for Sourabaya coffee was steady, ranging according to grade from \$20 to \$22 as compared with \$21.50 to \$24 during June.

Palembang coffee averaged \$14.60 during the month having dropped from \$15.50 on the 7th. to \$14 on the 28th. The average figure for June was \$13.90.

Arecanuts.—Palembang's averaged \$2.32 and Bila Whole \$2.63 per picul as compared with \$2.33 and \$2.66 during June. The range of Singapore prices for other grades were:—Split \$3 to \$4.50, Red Whole \$3.50 to \$5, Sliced \$10 to \$12.50, Kelantan \$4 to \$4.50.

Gambier.—Block Gambier increased in price towards the end of the month, the average price being \$4.37 per picul. Cube No. 1 averaged \$7.62. Corresponding figures for June were \$4.64 and \$7.40 respectively.

Pineapples.—Values again firmed slightly during July, the average Singapore price per case being; Cubes \$3.22, Sliced Flat \$3.15, and Sliced Tall \$3.39, as compared with \$3.09, \$3.00, and \$3.22 respectively during June.

Tapioca.—The price of Flake fair average \$4.20 as compared with \$4.12 in June. Pearl Seed averaged \$5.19 as compared with \$5.37 in June and Pearl

Medium averaged \$5.31 as compared with \$5.62 in the previous month.

Sago.—Pearl—Small Fair remained steady at around \$4.50 as compared with \$4.75 in June. Flour—Sarawak Fair averaged \$1.91 as compared with \$1.90 in June.

Mace.—Prices increased somewhat during the month, the figures being \$70 per picul for Siouw and \$50 for Amboina. The ruling prices during June were \$65 and \$45 respectively.

Nutmegs.—There was a slight drop in prices during the month, Singapore price per picul for 110's was \$21.25 as compared with \$22.75 in June, 80's averaged \$29.12 having averaged \$31.50 in the previous month.

Pepper.—Average Singapore prices during July were as follows:—Singapore Black \$14.69 per picul, Singapore White \$26 and Muntok White \$26.50, the corresponding prices for June were \$17.75, \$29 and \$29.75 respectively.

Cloves.—As in the previous months the demand for cloves remains small, nominal prices being \$40 for Zanzibar and \$45 per picul for Amboina.

GENERAL RICE SUMMARY.

June 1933.

Malaya.—Gross foreign imports of rice (including stocks available for re-export) during June 1933, amounted to 43,585 tons, as compared with 46,668 tons in June 1932, of which 46 per cent. were consigned to Singapore, 19 per cent. to Penang, 8 per cent. to Malacca, 21 per cent. to the Federated Malay States and 6 per cent. to the Unfederated Malay States.

Of these imports, 51 per cent. were from Siam, 43 per cent. from Burma, 4 per cent. from Indo-China and 2 per cent. from other countries.

Total foreign exports of rice from Malaya in June 1933, were 11,995 tons (including 377 tons local production) as compared with 12,393 tons in June 1931.

Of these exports 83 per cent. were consigned to Netherlands India and 17 per cent. to other countries.

Net imports for the period January to June 1933, were 200,671 tons as compared with 209,482 tons during the same period for 1932, a fall of 4 per cent.

India and Burma.—Total foreign exports of rice during May 1933, were 230,000 tons as compared with 205,000 tons in the previous month and 239,000 tons in May 1932.

Siam.—Exports (approximate) during June 1933, amounted to 120,345 tons as compared with 130,564 tons in June 1932.

Netherlands India, Java and Madura.—For the period end of May 1933, the area harvested amounted to 4,786,000 acres a decrease of 219,000 acres or 4 per cent. as compared with the corresponding period of 1932: the area damaged was 187,000 acres an increase of 22,000 acres or 13 per cent. as compared with 1932, and additional plantings awaiting harvesting amounted to 3,950,000 acres an increase of 673,000 acres or 10 per cent.

French Indo-China.—Entries of padi at the port of Cholon from January to June 1933, amounted to 667,838 metric tons, an increase of 27,416 tons or 4 per cent. as compared with the same period of 1932.

Exports of rice from Saigon for the period January to June 1933, totalled 788,276 tons, an increase of 152,390 tons or 24 per cent. as compared with the corresponding period of 1932.

Europe and America.—Quantities of rice shipped from the East were:—

- (a) To Europe for the period January 1st to June 22nd, 752,076 tons, a rise of 207,065 tons or 38 per cent. as compared with the same period of 1932. Of these shipments 53 per cent. were from Burma, 3 per cent. from Japan, 37 per cent. from Saigon, 6 per cent. from Siam and 1 per cent. from Bengal as compared with 62 per cent. from Burma, nil from Japan, 31 per cent. from Saigon, 3 per cent. from Siam and 4 per cent. from Bengal in 1932.

- (b) To the Levant, period January 1st to May 22nd, 16,691 tons, a fall of 17,402 tons or 51 per cent. as compared with the same period of 1932.
- (c) To America and the West Indies for the period January 1st to May 17th, 62,351 a decrease of 5,487 tons or 8 per cent. as compared with the same period of 1932.

MALAYAN AGRICULTURAL EXPORTS, JUNE 1933.

PRODUCT.	NET EXPORT IN TONS.				
	Year 1932	Jan-June 1932	Jan-June 1933	June 1932	June 1933
Arecanuts ...	20,280	13,481	10,613	2,861	1,428
Coconuts, fresh† ...	108,123†	63,787†	48,794†	9,578†	11,129†
Coconut oil ...	11,932	5,187	9,443	925	1,536
Copra ...	97,464	37,054	39,095	8,486	3,344
Gambier, all kinds ...	2,925	1,502	1,217	224	177
Palm kernels ...	1,248	526	792	40	180
Palm oil ...	7,892	3,176	4,093	425	340
Pineapples canned ...	66,291	37,202	32,674	6,137	8,097
Rubber § ...	417,137	200,321	208,747	30,701	39,552
Sago,—flour ...	10,267	5,188	1,934	1,072	98
" —pearl ...	3,128	1,228	1,049	102	163
" —raw* ...	4,148*	2,080*	2,037*	619*	393*
Tapioca,—flake ...	9,028	4,521	6,008	595	896
" —flour ...	392	163*	141*	87*	40
" —pearl ...	19,977	10,448	7,975	1,964	1,023
Tuba root ...	165‡	50	231	‡	49

† hundred in number.

§ production.

* net imports.

MALAYA RUBBER STATISTICS

ACREAGES OF TAPPABLE RUBBER NOT TAPPED ON ESTATES OF 100 ACRES AND OVER, FOR THE MONTH ENDING JUNE, 1933

STATE OR TERRITORY	Acreage of Tappable Rubber end 1932	ESTATES WHICH HAVE ENTIRELY CEASED TAPPING				ESTATES WHICH HAVE PARTLY CEASED TAPPING		Total (3) + (5)	Percentage of (7) to (2)
		Acreage (3)	Percentage of (3) to (2) (4)	Acreage (5)	Percentage of (5) to (2) (6)	(7)			
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)		
STRAITS SETTLEMENTS :—									
Province Wellesley	44,734	1,725	3.8	8,220	18.4	9,945	22.2		
Dindings	6,969	209	3.0	1,087	15.6	1,296	18.6		
Malacca	111,780	5,315	4.7	20,070	18.0	25,385	22.7		
Penang Island	1,635	776	47.5	180	11.0	956	58.5		
Singapore Island	28,269	10,877	38.5	4,767	16.8	15,644	55.3		
Total S.S.	193,387	18,902	9.8	34,324	17.7	53,226	27.5		
FEDERATED MALAY STATES :—									
Perak	230,951	10,475	4.2	34,042	13.5	44,517	17.7		
Selangor	308,379	18,079	5.8	41,545	13.5	59,624	19.3		
Negri Sembilan	228,541	15,739	6.9	19,899	8.7	35,638	15.6		
Pahang	38,141	7,870	20.6	4,926	12.9	12,796	33.5		
Total F.M.S.	826,012	52,163	6.3	100,412	12.2	152,575	18.5		
UNFEDERATED MALAY STATES :—									
Johore	325,747	38,717	11.9	32,373	9.9	71,090	21.8		
Kedah (a)	114,551	8,909	7.8	6,985	6.1	15,894	13.9		
Kelantan	21,175	9,560	45.1	1,500	7.1	11,060	52.2		
Trengganu (b)	4,352	Nil	Nil	2,072	47.6	2,072	47.6		
Perlis (a)	957	177	18.5	542	56.6	719	75.1		
Total U.M.S.	466,782	57,363	12.3	43,472	9.3	100,835	21.6		
Total MALAYA	1,486,181	128,428	8.6	178,208	12.0	306,636	20.6		

Notes :— (a) Registered companies only and are rendered quarterly.

(b) Registered companies only.

The above table together with a Summary, was prepared and published by the Statistics Department, S.S. and F.M.S. in July 1933.

TABLE I
MALAYA RUBBER STATISTICS
STOCKS, PRODUCTION, IMPORTS AND EXPORTS OF RUBBER, INCLUDING LATEX, CONCENTRATED LATEX AND REVERTEX,
FOR THE MONTH OF JUNE, 1933 IN DRY TONS.

Territory	Stocks at beginning of month 1			Production by estates of 100 acres and over			Imports			Exports including re-exports			Stocks at end of month		
	Ports	Dealers	Estates of 100 acres and over	during the month	to the month	January to June 1933	during the month	From Foreign	From Malay States	From Labuan	during the month	January to June 1933	Ports	Dealers	Estates of 100 acres and over
1															
MALAY STATES :-															
Federated Malay States	...	12,729	10,664	11,816	64,676	10,192	Nil	Nil	Nil	Nil	12,346	8,655	79,549	87,258	...
Johore	...	2,820	3,294	3,777	21,018	4,218	Nil	3	Nil	20	1,430	6,361	6,889	39,170	...
Kedah	...	485	2,047	2,443	13,293	1,428	Nil	2	Nil	Nil	1,224	2,614	6,711	14,636	...
Perlis	24	10	6	4	Nil	Nil	Nil	Nil	Nil	23	Nil	114	...
Kelantan	...	287	138	908	918	555	Nil	73	Nil	Nil	50	707	422	2,986	...
Trengganu	...	55	50	130	672	65	Nil	Nil	Nil	Nil	Nil	195	Nil	1,007	...
Total Malay States	...	16,410	16,203	18,380	100,724	16,466	Nil	3	77	20	15,070	18,755	93,371	95,171	...
SEMITERRITORIES :-															
Malacca	...	3,902	1,373	1,339	7,619	...	1	Nil	10	Nil	3,368	...	24,625	...	3,797
Province Wellesley	...	955	517	5,65	2,913	...	Nil	Nil	Nil	Nil	...	...	36,174	...	1,370
Dindings	...	32	99	98	556	...	Nil	18,804	Nil	95,391	5,566	Nil	Nil	...	29
Penang	...	1,362	3,940	134	164	878	778	3,171	...	...	...	...	1,748	4,417	77
Singapore	...	3,131	24,554	134	164	878	11,667	43,014	...	...	...	...	6,518	28,538	135
Total Straits Settlements	...	4,493	33,388	2,128	2,170	11,979	12,446	18,804	46,705	95,391	17,435	...	8,261	38,151	2,292
TOTAL MALAYA	...	4,493	49,793	18,331	20,550	112,709	19,002	66,044	12,446	18,807	46,272	95,411	41,438	18,755	247,261

TABLE II
DEALERS' STOCKS IN DRY TONS 3

Class of Rubber	Federated Malay States	Singapore	Penang	Wellesley	Province Wellesley	Malacca	Kedah
20	21	22	23	24	25	26	27
DRY RUBBER	9,311	22,711	3,776	4,932	1,050	190	...
WET RUBBER	3,447	5,827	641	264	1,874	326	...
TOTAL	12,758	28,538	4,417	5,196	2,924	516	...

TABLE III
FOREIGN EXPORTS

Ports	For month	January to June 1933
Singapore	...	26,963
Penang	...	9,017
Port Swettenham	...	5,080
Malacca	...	379
MALAYA	...	41,439

TABLE IV
DOMESTIC EXPORTS 4

Area	For month	January to June 1933
Malay States	...	29,918
Straits Settlements	...	20,316
MALAYA	...	29,918

Notes—1. Stocks on estates of less than 100 acres and stocks in transit on rail, road or local steamer are not ascertained.
2. The production of estates of less than 100 acres is estimated from the formula: Production + Imports + Stocks at beginning of month = Exports + Stocks at end of month. Consumption, i.e., Column [7] + Column [13] + [14] + [15] + [16] + [17] + [18] + [19] + 10 tons local consumption during the month — [2] — [3] — [4] — [5] — [9] — [10]. For the Straits Settlements, Columns [7] and [8] represent purchases by dealers from local estates of less than 100 acres, reduced by 15% to terms of dry rubber.
3. Dealers' stocks in the Federated Malay States are reduced to dry weights by the following fixed ratios: unsmoked sheet, 15%; wet sheet, 25%; scrap, lump, etc., 40%. Stocks elsewhere are in dry weights as reported by the dealers themselves.
4. Domestic production is estimated by deducting the average monthly dry weight of foreign imports over a period of 2 months from the gross foreign exports of the Malay States being domestic production.
5. The above, with certain omissions, is the Report published by the Registrar-General of Statistics, S.S. and F.M.S., at Singapore on 22nd July 1933.

METEOROLOGICAL SUMMARY, MALAYA, JUNE, 1933.

LOCALITY	AIR TEMPERATURE IN DEGREES FAHRENHEIT				EARTH TEMPERATURE		RAINFALL								BRIGHT SUNSHINE				
	Means of				Absolute Extremes				At 1 foot	At 4 feet	Total	Most in a day	Number of days				Total	Daily Mean	Per cent
	A. Max.	B. Min.	Mean of A and B	°F	°F	°F	°F	°F					°F	°F	Precipitation 0.05 in or more	Thunderstorm				Fog morning obs	Gale force 8 or more
									Lowest	Lowest	Max.	Highest							
		°F	°F	°F	°F	°F	°F	°F	°F	°F	in.	mm.	in.	in.	in.	in.	in.	hr.	hr.
Railway Hill, Kuala Lumpur, Selangor	91.3	71.8	81.5	94	69	87	75	84.7	85.4	6.37	161.8	2.62	10	9	5	1	227.90	7.60	62
Bukit Jeram, Selangor	89.5	73.1	81.3	92	70	87	75	86.2	87.5	1.40	35.6	1.14	5	3	2		244.25	8.14	66
Sitiawan, Perak	92.7	72.5	82.6	95	70	85	75	85.8	86.4	1.90	48.3	0.55	8	6	2		235.70	7.86	64
Kroh, Perak	86.7	68.5	77.6	90	63	79	72	82.2	83.4	6.05	153.7	1.72	14	9	1	3	216.05	7.20	58
Temerloh, Pahang	90.6	72.2	81.4	93	69	87	75	85.8	86.5	2.50	63.5	0.69	10	9	1		223.70	7.46	61
Kuala Lipis, Pahang	89.5	71.6	80.5	91	67	87	74	84.9	85.4	4.82	122.4	1.87	8	6	3	18	197.15	6.57	53
Kuala Pahang, Pahang	88.5	74.6	81.5	91	71	84	77	86.5	86.3	2.07	52.6	0.61	9	7	3		222.10	7.40	60
Mount Faber, Singapore	89.0	75.6	82.3	92	70	81	80	82.7	83.2	10.07	255.8	1.98	15	13	2		198.90	6.63	54
Butterworth, Province Wellesley	89.0	74.0	81.5	91	70	80	77	85.7	86.3	2.98	75.7	1.59	9	7		1	223.25	7.44	60
Bukit China, Malacca	85.7	73.8	79.7	87	69	81	77	83.6	84.4	7.16	181.9	3.58	9	6	5		212.20	7.07	57
Kluang, Johore	88.8	71.1	79.7	92	67	83	73	82.3	83.1	6.46	164.1	4.01	12	10	2	8	202.80	6.76	55
Bukit Lalang, Mersing, Johore	88.9	72.4	80.7	92	70	86	75	82.6	82.8	6.58	167.1	2.69	9	9	4		229.30	7.64	62
Alor Star, Kedah	89.0	74.0	81.5	92	71	81	77	86.4	86.7	5.27	133.9	1.66	13	11	2	1	218.10	7.27	59
Kota Bharu, Kelantan	91.0	73.4	82.2	94	71	87	77	85.2	85.5	5.25	133.4	2.36	9	6	2		209.00	6.97	56
Kuala Trengganu, Trengganu	88.7	72.8	80.7	91	70	86	76	84.2	85.4	4.84	122.9	1.05	11	11	3	1	210.00	7.00	56
HILL STATIONS.																			
Fraser's Hill, Pahang 4268 ft.	75.2	63.7	69.5	79	59	71	66	71.8	72.6	2.50	63.5	0.52	9	7	2	1	214.30	7.14	58
Pahang Highlands, Tanah	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Cameron Highlands, Tanah	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Rata, Pahang 4750 ft.	73.1	54.5	63.8	77	49	68	60	70.3	70	3.96	100.6	2.18	10	10	5		205.95	6.87	55
Cameron Highlands, Rhododendron Hill, Pahang 5120 ft.	72.8	59.8	66.3	76	58	65	62	4.15	105.4	2.47	9	9			213.25	7.11	57

Compiled from Returns supplied by the Meteorological Branch, Malaya.

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THE Malayan Agricultural Journal.

SEPTEMBER, 1933.

EDITORIAL.

Oil Palm Factory Control.

A feature of every oil palm estate is the factory in which the freshly harvested fruit bunches are treated for the recovery of the two products for export — palm oil and palm kernels.

Both products, more particularly the oil, are characterised by a high standard of quality, which can only be maintained by treating the fruit bunches with as little delay as possible after harvesting and by careful control of the various intermediate processes through which the material passes. In order to furnish an idea of the rate of treatment it may be mentioned that the transfer of the oil from the palm to the storage tank is complete within 24 hours.

The maintenance of a high standard of quality necessitates the factory being equipped with the latest machinery, especially when it is remembered that with the seasonal fluctuations in the amount of the crop the factory must often work continuously for weeks at a time.

While quality of product must be maintained the question of output is, however, of primary importance, especially in view of the relatively heavy losses of products that may occur owing to the number of separate processes through which the fruit passes, for example, sterilisation of bunches, separation of fruit, expression or centrifugal extraction, purification of oil. Further, as will be realised these losses chiefly concern the palm oil, which is the more valuable of the two products and is also present in the fruit in the larger proportion.

The relatively heavy capital outlay incurred in equipping the factory, the present low prices for oil palm products and the necessity for reducing losses of products to a minimum, to avoid incurring financial loss, necessitate consideration being given to the question of adoption of a system of factory control.

In the article included in the present number entitled "A System of Control for Oil Palm Factories," by Major C. D. V. Georgi, the author outlines a simple system based largely on the results of the investigations carried out in the oil palm factory at the Government Experimental Plantation, Serdang.

Briefly, the system consists firstly in recording the weights or volumes of all materials entering or leaving the factory, secondly in analysing representative samples of all waste products. The author points out that all three operations involved, weighing or measuring, sampling and analysis are of equal importance and must therefore be carried out with corresponding accuracy.

As a result of the various operations a statement can be compiled in which the results of the working of the factory, covering a particular period, may be tabulated.

While a single factory control statement is of comparatively little value, except in so far as it affords a general indication of the efficiency of the process, a series of statements in which details of factory practice for the individual stages are correlated with losses of products will prove of the utmost value to the management in working out the optimum conditions for the whole process, thereby reducing losses to a minimum.

Although the adoption of a system of factory control necessitates the provision of a chemical laboratory and an adequate staff it is shown that in the case of a large estate of 10,000 acres the expenditure would be amply repaid, seeing that with such an estate in full bearing a variation of only one half per cent. in the output of palm oil alone is equivalent at present prices to more than \$6,000 per annum.

In conclusion it may be mentioned that, while factory control is new to Malaya, similar systems have long been a feature of technical factory practice in connection with estate crops in other countries. For example, the high standard of efficiency reached in the modern sugar mill as a result of factory control furnishes an excellent example of the value of such a system, which therefore may well be copied by those oil palm estates anxious to maintain the maximum recovery of high quality products.

Poultry in India.

In the June number of the *Malayan Agricultural Journal* an article on Diseases of Poultry with Notes on Poultry Rearing was published, and it was pointed out that interest in poultry keeping had become greatly intensified in Malaya during the past eighteen months, probably largely due to the economic depression.

In the present number of this Journal, an abstract from the Madras Agricultural Journal, entitled "The Poultry Industry of India", is included. It is felt that the information contained in the article will be of interest to Malayan poultry keepers, since it appears that the problems confronting the industry in India in many respects resemble the difficulties experienced in Malaya.

The article gives an interesting account of the steps which have been taken, in India, by the Governments of various Provinces, to improve the condition of the poultry industry. The methods now being adopted in Malaya, with the same object in view, are, to a large extent, on similar lines to those which have been in operation in India since the year 1919.

There is, as yet, a lack of authoritative literature dealing with poultry in Malaya, and until the work which is being fostered by the Department of Agriculture, S.S. & F.M.S., is more advanced, the main supply of available information, must come from other countries where the work has been in progress for a longer period. It must be appreciated that, although poultry problems in Malaya may vary in some respects from those in other countries,

on account of differences in local conditions, there are undoubtedly a very large number of problems common to every country and it is felt that the dissemination of information on such matters is very desirable since it should tend to stimulate interest and enquiry amongst those engaged in poultry rearing.

Gingelly.

The present number of this Journal contains an article by Messrs. J. N. Milsum and J. Lambourne on the cultivation of gingelly. The oil obtained from the seeds of this plant is extensively used, principally by Southern Indians, for culinary purposes and appreciable quantities of seed are imported annually into Malaya where the oil is extracted by Indians in the neighbourhood of the larger towns.

The recent imposition, in the Federated Malay States, of an import duty of 4 cents per pound full duty, and 2 cents per pound preferential duty, is a factor which should tend to encourage the extension of the crop locally, with the object of producing sufficient oil to meet the local demand. It is estimated that in order to replace the amount of the net imports of gingelly into Malaya in 1932 *i.e.* seed 2,708 tons, oil 11 tons, approximately 10,000 acres annually planted with gingelly would be required. This estimate is based on an average yield of 600 lbs. of cleaned seed per acre. The acreage under this crop in Malaya is negligible.

Present market prices for gingelly seed range from \$4.50 to \$6 per picul according to quality; the return therefore is unlikely to exceed \$27 per acre, which would not permit of any profit being made with paid labour, unless gingelly was grown in rotation with a more paying crop. As a rotation crop grown by small-holders gingelly, however, has possibilities since it matures in just over three months from sowing and there is a considerable demand for seed locally.

It is evident that the crop, like all annual crops in the tropics requires soil well supplied with humus and available plant foods if a remunerative yield is to be secured.

A SYSTEM OF CONTROL FOR OIL PALM FACTORIES.

BY

C. D. V. GEORGI,

Acting Agricultural Chemist.

Introductory.

Factory control may be defined as the collection and analysis of various data regarding the different stages of the particular factory process involved with the object of obtaining the highest efficiency for the whole process compatible with the most economical method of working.

The importance of the adoption of some system of control for any technical factory will be recognised, especially in these days when, as a result of prevailing low prices for products and a consequently narrow margin of profit, financial loss may be incurred, unless a high standard of efficiency is maintained.

An estate oil palm factory forms an excellent example for the necessity of the introduction of a system of control. A relatively heavy capital charge is incurred in the erection and equipping of the factory, the present prices of oil palm products are low, and the fruit passes through a number of processes in which losses of products occur.

In the present paper therefore a simple system of control suitable for adoption in oil palm factories will be outlined for the purpose of bringing to the notice of those interested the details of the procedure necessary for ensuring the recovery of the maximum percentages of palm oil and palm kernels.

From the point of view of factory control, palm oil is more important than palm kernels for the following reasons :

- (i) The proportion of palm oil in the fresh fruit is much greater than that of palm kernels,—29 per cent. of palm oil compared with 6 per cent. of palm kernels.
- (ii) The unit price of palm oil is more than double that of palm kernels, the present prices being approximately £18 per ton for palm oil, compared with £8 per ton for palm kernels.

In any system of oil palm factory control therefore it will be realised that more attention must be given to a study of the losses of oil compared with kernels, the recovery of which is a simple operation. Further, it must be remembered that owing to the larger number of operations necessary for the recovery of the oil there are increased chances of losses in respect of this product.

Apart from the actual extraction process, a large oil palm factory, dealing with the crop from 10,000 acres or more, lends itself to control from other points of view, for example, steam and power consumption. It is not proposed, however, to deal with these aspects in the present paper, which, as stated previously, will be restricted to a consideration of the factors regarding maximum recovery of products.

General Considerations on Factory Control.

Three essentials are necessary for control in a technical factory (*a*) measurements of either weight or volume (*b*) sampling (*c*) analysis. All these operations are of equal importance, and must therefore be carried out with corresponding accuracy.

Unless, for example, the amount of a particular waste product, involving a loss of oil, has been carefully recorded and the material sampled according to a recognised procedure the final figure for the total loss of oil, which is based on the results of the analysis, may be entirely inaccurate, however carefully the analysis itself may have been made.

It cannot be emphasised too strongly that the success of a system of factory control lies just as much in the accurate recording of the weights or volumes of the different materials and in the manner in which those materials are sampled, as in the analyses themselves. Errors in the factory cannot be rectified in the laboratory, they are more likely to be aggravated.

Provision must therefore be made for the installation of weighing machines at all stages of the process, where it is necessary to record weights of materials. Such machines should be preferably of an automatic type, provided the size of the factory is large enough to warrant such expenditure.

Similarly, in those cases where volume measurements are concerned, it will be necessary to arrange for the calibration of tanks and other containers, so that, for example, by measuring a difference in level of a liquid in a tank an accurate indication may be obtained of the volume of liquid involved in the particular operation.

If the volumes are too large to admit of records being compiled without incurring delay in the process, then automatic recording instruments should be installed.

As regards sampling, it is not possible to lay down definite rules owing to differences in factory procedure. Provided, however, the essential principles of sampling as indicated below are adhered to, the results of analyses of different series of samples will be comparable.

- (i) The material is homogeneous.
- (ii) Samples are drawn at regular intervals throughout the process.
- (iii) A constant proportion is maintained between the sample and the amount of material sampled. If possible, the proportion should be not less than one half per cent.

For example, assuming the pericarp residue from the depericarper screen is collected in small trucks (capacity 400 lbs.), a definite amount, 2 lbs. should be taken at random from each truck load, as soon as the weight of the material has been recorded. These 2 lb. samples of pericarp residue may then be bulked, the material only being sampled for analysis at regular intervals as considered necessary.

Prior to sampling for analysis the weight of the material should be checked in order to ascertain the loss of weight, if any, during the period of collecting the individual samples, any loss being taken as due to evaporation of moisture. The necessary correction can be applied, and the gross weight of the sample calculated, assuming it to have been drawn at the time of the original weighing.

Similarly, if wash water is being run off from a tank, a definite amount of water, 100 c.c., is taken with every 2 inch or 3 inch fall of the level of the contents in the tank. The separate samples are bulked, and the requisite sample drawn for analysis.

These two examples have been given in order to show the possibility of reducing the number of samples for analysis by relying upon a systematic method in drawing them. Thus, in the case of the pericarp residue it might only be necessary to analyse a sample after 3 or 4 hours working or, in the case of the wash water, when a certain set of tanks had been emptied.

The variable nature of the products to be analysed necessitates a well-equipped laboratory and above all, an adequate staff. The question of the necessary laboratory equipment will be discussed later.

As regards the staff the number will depend on the size of the plant, and the extent to which factory control is to be carried out.

Since, however, practically all the analyses are of a routine nature, it is considered that an Asiatic staff would be capable of carrying out the analytical work required.

The extent of the European supervision will depend upon the size of the factory. While in the case of estates of 5,000 acres or less the factory engineer might possibly combine the work of supervising the Asiatic staff with his other duties, for larger estates the full time services of a supervising chemist would certainly be required.

The Asiatic staff should also be trained in recording accurately the weights and volumes of materials involved and in the sampling of the various waste products for analysis. These last two points are stressed once again, since experience in the interpretation of the results of analysis of oil palm materials has shown the writer that their importance, compared with the actual analytical work, is apt to be overlooked.

Measurements of Weight and Volume.

As indicated previously, a system of factory control necessitates the recording of a considerable number of weights and volumes of the different products at various stages of the process.

In the present section therefore it is proposed to give a list of the various records required in connection with the subsequent calculations regarding either the percentage recoveries of products or the losses of products at different stages of the process,

Assuming that (a) the factory process commences with the sterilisation of the fruit bunches, (b) there is no secondary treatment of the pericarp residue (c) palm oil and palm kernels are the finished products, the list is as follows :

1. Weight of fruit bunches.
2. Volume of condensed water from sterilisers.
3. Weight of bunch residue.
4. Weight of threshing machine waste.
5. Weight of sterilised fruit.
6. Weight of pericarp residue.
7. Weight of clean nuts from screen.
8. Volume of waste water from oil-washing tanks.
9. Volume of waste water from sludge recovery plant.
10. Weight of palm oil.
11. Weight of palm kernels.

1. *Fruit bunches.* As is well-known, in any large factory, the trucks containing the fruit bunches pass over a weighbridge on entering the factory, the weight of the bunches in any particular truck being obtained by deducting the tare weight of the truck from the gross weight as recorded on the weighbridge. The trucks are all numbered, and a list of the tare weights is kept for reference.

2. *Condensed water from sterilisers.* The principal object in measuring the amount of condensed water is to have a check both on the consumption of steam and on the loss in weight of the fruit bunches due to evaporation of moisture in the process of sterilising under pressure. The condensate is usually collected in tanks, two being placed side by side, so that when one is being filled the other may be emptied. As explained previously, the tanks should be calibrated, so that an accurate indication of the volume involved can be obtained by measuring the height of the liquid in the particular tank.

Any oil collecting on the surface of the water should be skimmed off and added to the crude oil in the factory.

3. *Bunch residuc.* The fruit bunches after threshing are collected in trucks, which can leave the factory over the same weighbridge as that on which the fruit bunches were weighed.* Owing to the possibility of loss in weight due to evaporation of moisture the residual fruit bunches should be weighed as soon as possible after threshing.

4. *Threshing-machine waste.* The weight of the waste material from the threshing machine must be recorded. This is usually carried out by arranging for the discharge of the material from the stripper into trucks, which can be run in below the threshing machine. The trucks, which could pass over the same weighbridge as that used for recording the weight of the sterilised fruit, would be tared similarly to those used for the fruit bunches.

5. *Sterilised fruit.* Although the recovery of products is usually based on the original weight of fresh bunches it is also important from the point of

view of control of process to have an additional check on the amounts of products compared with that of the sterilised fruit, since the latter really represents the raw material, as far as the actual process of recovery of products is concerned.

If the weight of fruit bunches is taken as a basis, greater variations are likely to occur in the calculated figure for the percentage of oil recovered owing to variations in the amount of fruit in the bunch, especially if a proportion of the bunches are from young palms. Further, the question of the incomplete threshing of bunches must not be overlooked.

In large factories it would be advisable to arrange for the installation of an automatic weighing machine to record the weight of fruit; in smaller factories, which cannot afford expenditure on such apparatus, arrangements should be made for the installation of a small weighbridge over which trucks containing the sterilised fruit would pass.

6. *Pericarp residuc.* This material would be weighed as it left the depericarper screen. For this purpose a weighbridge should be installed near the end of the screen, so that trucks filled with the residue can be weighed, before the latter is used as fuel for the boilers.

7. *Clean nuts from screen.* The clean nuts leaving the depericarper are collected in trucks, which could pass over the same weighbridge as that used for recording the weights of the trucks containing the pericarp residue.

8. *Waste water from oil-washing tanks.* The volume of the water from the oil-washing tanks run to waste must be measured. Provided the tanks have been calibrated previously, the volume can be determined with sufficient accuracy by noting the difference in level in the tank before and after running off the water, and multiplying by the necessary factor to convert to gallons.

9. *Waste water from sludge recovery plant.* Similar measurements of the volume of the water run to waste from the sludge recovery plant must be taken.

10. *Palm oil.* The weight of purified oil must also be recorded. If the oil is being shipped in barrels or drums this is a simple operation, but if, as is more likely, the oil is being shipped in bulk a different procedure must be adopted. In this case the oil is pumped into tanks, in which the volume can be measured, the weight of oil in lbs. being calculated by multiplying the volume of oil in gallons by 0.9. Although the latter figure is only an approximation, the method of calculation is considered sufficiently accurate for the purpose of factory control.

An automatic machine for weighing the oil on passing to the bulking tank could be installed; such a refinement, although resulting in much greater accuracy, is, however, considered scarcely necessary.

11. *Palm kernels.* The kernels are packed in bags, which are weighed on leaving the factory, prior to being stored for shipment.

Sampling.

In the present section it is proposed to refer briefly to certain points connected with the sampling of the various products for analysis.

While, as explained previously, it is not possible to lay down a definite procedure applicable to all factories, representative sampling can always be ensured, provided the method adopted is based on the principles already laid down.

In order to preserve uniformity it is proposed to refer to all the products previously enumerated, even though in some instances no sampling is required.

1. *Fruit bunches.* No sampling of bunches is carried out.
2. *Condensed water from sterilisers.* Sampling of the condensed water may be carried out, either by means of a drip tap fitted into the pipe leading from the tank or by taking a sample of the water from the end of the pipe at regular intervals throughout the discharge. In the case of the drip tap, care must be taken to ensure that the tap does not become choked.
3. *Bunch residue.* While regular sampling for analysis is unnecessary on account of the low oil content of the material, it is considered advisable at definite intervals, for example once a week, to check the percentage of sterilised fruits in the bunch residue and to take a sample of the cleaned residue for analysis.

A truck load of threshed fruit bunches is selected at random and passed through the threshing machine in order to ensure complete separation of fruit. The sterilised fruit is cleaned from adhering bracts and stalks, weighed, and the proportion in the bunch residue calculated.

Ten pounds of the cleaned residue, obtained by chopping small pieces from individual bunches, are weighed, dried in the sun and the loss in weight recorded. The dried material is chopped still more finely prior to being sampled for analysis.

4. *Threshing machine waste.* A sample of material is drawn from each truck and the weights of the individual samples recorded. When sufficient waste has accumulated, the bulk sample is weighed again and the loss, due to evaporation of moisture between weighing and sampling, is calculated.

5. *Sterilised fruit.* Sampling of sterilised fruit is only necessary in that system of control in which the calculated results of the factory process are compared with those obtained by carrying out the same process on a small scale.

In the latter case, for example, all the individual samples of fruit collected during the working day are bulked and treated as a separate charge in the press or centrifugal extractor, similar records being compiled and similar analyses carried out for the waste products from this charge as for the whole of the fruit treated in the factory during the same period.

While the alternative method provides a check on the original results, the adoption of such a procedure must increase considerably the work of the laboratory staff and it is not therefore proposed to recommend its adoption at present in oil palm factory practice in Malaya.

6. *Pericarp residue.* Samples of the pericarp residue are drawn from the trucks after having passed over the weighbridge. The weight of the bulk sample should be checked before sampling for analysis in order to account for loss in weight due to evaporation of moisture.

7. *Clean nuts from screen.* A similar procedure to that recommended for the pericarp residue should be adopted in the case of this material.

8. *Waste water from oil-washing tanks.* Sampling of the waste water from the washing tanks is carried out either by means of a drip tap fitted to the pipe leading from the tank or by taking a sample of water from the end of the pipe at regular intervals throughout the discharge. Owing to the presence of a certain amount of solid matter in the water care must be taken to ensure the proper working of the drip tap.

9. *Waste water from sludge recovery plant.* A similar procedure to that recommended for the waste-water from the oil-washing tanks should be adopted.

10. *Palm oil.* Samples of oil may be taken by means of a drip-tap fitted to the pipe leading to the storage tank.

11. *Palm kernels.* A small handful, 20 kernels, is taken from each bag and bulked for the purpose of drawing an average sample.

Selection of Samples for Analysis.

Before describing the methods of analysis for the various products it is considered advisable to draw attention to the necessity of ensuring thorough mixing of the bulk sample before drawing one for analysis.

While this is simple for the liquid materials, since the bottle or other closed container can be well shaken, thereby ensuring homogeneity of contents, special precautions must be taken in the case of the solids.

As is well-known, the usual method of drawing a sample for analysis from solid materials, such as those under discussion, is to mix the individual samples into a heap, which is gradually reduced in size by the method of quartering. This process is continued, until only a small quantity of the original material remains, when the sample for analysis can be drawn.

In order to ensure satisfactory results with the method of quartering it is essential that the material should be of an even size. If therefore, for example, the threshing machine waste bulk sample should contain a proportion of bunch stalk, the latter should be picked out, cut into small pieces and re-mixed with the remainder of the material before quartering commences.

Methods of Analysis.

Apart from the analyses of the ultimate products, palm oil and palm kernels, to which reference will be made later, the analytical determinations in the case of the waste products are comparatively simple. Only two estimations are comprised, moisture and oil, while in some instances it is unnecessary to determine even moisture, provided the material is dried sufficiently to permit of the oil being completely extracted on treating with a solvent.

The simplest method for the determination of moisture is by drying the material to constant weight in a steam oven at 100°C. Since there is an ample supply of steam in the factory, there would be no difficulty as regards a supply for the laboratory.

The most satisfactory method for the estimation of oil is by treating the dried material with a solvent in an extractor, for example, Soxhlet type, filtering the solvent extract, evaporating off the solvent and drying the residual oil to constant weight in the steam oven.

As regards a suitable solvent it is suggested that petroleum ether having a boiling point range 60°—80°C. could be used. Although such a solvent is not free from fire-risk, the danger is small, since the extraction flasks may be heated on a steam bath and similarly, when the solvent is being evaporated, the same procedure may be adopted. Further, the difference of 20°C., between the boiling point of the highest fraction in the solvent and the temperature of the steam oven, would ensure the comparative rapid drying of the residual oil.

When estimating the amount of oil in liquid waste products, for example, waste water from the washing tanks, the measured volume of liquid is first evaporated to dryness. The solid residue is treated in a Soxhlet extractor with solvent to remove the oil, which is dried and weighed. The oil content of the original liquid is then calculated.

Having now described briefly the general analytical methods it is proposed to refer to certain points connected with the various products previously enumerated.

1. *Fruit bunches.* No analysis is required.
2. *Condensed water from sterilisers.* A measured volume of the water, 200 c.c., is evaporated to dryness on the steam bath, the residue transferred to a Soxhlet extractor for treatment with petroleum ether. Owing to the somewhat sticky nature of the residue the latter should be ground with a small proportion of ignited sand in order to ensure satisfactory penetration of the solvent.
3. *Bunch residue.* The sample of cleaned bunch residue, 100 grammes, would be further dried in the steam oven and then extracted as described. After extracting for 2 hours it is advisable to grind the material with a small proportion of sand, to replace in the extractor and to continue the process for a further 4 hours, in order to ensure complete removal of the oil.
4. *Threshing machine waste.* The sample of threshing machine waste, 25 or 50 grammes, would be dried to constant weight in the steam oven and solvent extracted as described in the previous paragraph.
5. *Sterilised fruit.* No analysis is required.
6. *Pericarp residue.* The sample of pericarp residue, 25 grammes, would be dried to constant weight in the steam oven and solvent extracted as described in paragraph 3.
7. *Clean nuts from screen.* A weighed amount of nuts, between 80 and 100 grammes, is taken and dried in the steam oven for a few hours. The nuts are solvent extracted in order to remove the palm oil on the surface.

8. *Waste water from oil-washing tanks.* A similar procedure to that described for the condensed water from the sterilisers is adopted with the exception that, owing to the higher oil content of the liquid, a smaller volume, 50 c.c., may be taken for the estimation.

9. *Waste water from sludge recovery plant.* A similar procedure to that described for the waste water from the oil washing tanks is adopted.

10. *Palm oil.* Three determinations are necessary in the analysis of palm oil (a) Moisture (b) Dirt (c) Acidity.

(a) *Moisture.* The moisture content of the oil is determined by drying a weighed quantity of oil, 10 grammes, in an oven for 4 hours at a temperature of 105°C. The loss in weight on drying is calculated as moisture.

(b) *Dirt.* The dirt content of the oil is determined by diluting 50 grammes of the oil with petroleum ether (B.P. 60°–80°C.) and filtering off the insoluble matter, which is washed free from oil with more petroleum ether, dried and weighed. The dry residue is calculated as dirt.

(c) *Acidity.* The acidity of the oil may be determined by one of two methods, which may be referred to as the hot method and cold method respectively.

(i) *Hot method.* A weighed amount of the oil, 5 grammes, is treated with 50 c.c. of neutralised alcohol. The contents of the flask are brought to the boil and, while still hot, are titrated against decinormal caustic potash solution, using phenol phthalein as indicator. The number of c.c. of alkali solution required to produce a pale pink coloration, persisting for 5 seconds, is taken as the volume of alkali required to neutralise the free fatty acids present in the oil.

The acidity of the oil is calculated as palmitic acid, 1 c.c. of decinormal caustic potash solution being equivalent to .0256 grammes of palmitic acid.

(ii) *Cold method.* A weighed amount of oil, 5 grammes, is diluted with 25 c.c. of petroleum ether (B.P. 60–80°C.) and 50 c.c. of neutralised alcohol added. A few drops of phenol phthalein indicator are added and the liquid titrated with decinormal caustic potash solution until a permanent pale pink coloration persists in the alcohol layer.

The calculation of the acidity of the oil is carried out similarly to that used in the hot method.

11. *Palm kernels.* Although it is not customary to analyse palm kernels, since they are invariably analysed on arrival in Europe, it may be of interest to record the required details of analysis. These would comprise determinations of the following constituents (a) Shell and Dirt (b) Moisture (c) Oil.

(a) *Shell and Dirt.* A weighed amount of the sample, 500 grammes, is picked over to remove any fragments of shell and dirt. These are weighed and the proportion calculated.

(b) *Moisture.* Kernels are selected at random and, after being cut in half, thin transverse slices are cut from individual half-kernels. Care must be taken to keep the slices even. A weighed amount of the slices, 10 grammes, is dried in the steam oven to constant weight, the loss in weight representing moisture.

The figure for the moisture content is important from the point of view of the estate owing to the necessity of ensuring that the kernels have been dried sufficiently before packing and will not therefore deteriorate in transit.

(c) *Oil.* The dried material is treated with petroleum ether (B.P. 60°—80°C.) in a Soxhlet extractor. After 2 hours extraction the partially extracted slices are dried in the steam oven to remove petroleum ether, ground in a mortar with a small quantity of ignited sand and again extracted for a further period of 4 hours. The solvent extract is filtered and, after distilling off the petroleum ether, the oil is dried to constant weight in the steam oven.

In calculating the percentage oil content of kernels no allowance is made for the shell and dirt, the oil content being calculated on the sample as received.

Consideration of Results.

As a result of the various operations described a statement is compiled, in which the results of the working of the factory process for the particular period are tabulated.

A suggested proforma is given in Appendix I.

Although at first sight the statement may appear complicated, an examination will show that the statement consists merely of a summation of the various data obtained as a result of studying the individual stages of the process.

A preliminary study of the individual stages is therefore the first essential in the development of an efficient factory process. This was shown in the investigation on the comparative efficiencies of the centrifugal and press processes carried out recently at the Government Experimental Plantation, Serdang, the results of which have already been published in this Journal (1) (2).

While therefore a single factory control statement is of comparatively little value, except in so far as it affords an indication of the efficiency of the process, a series of statements in which slight changes in detail of factory practice are correlated with losses of oil, will prove of the utmost value to the chemist or factory engineer in working out the optimum conditions for the whole process.

Having then ascertained the optimum conditions, the figures in successive control sheets should show only very slight variations, and the reason for any increase in the loss of oil at any particular stage of the process should be easily explained. This was also borne out by the results of the Serdang investigations referred to previously; for example the figures for the percentage efficiency of the centrifugal process in four successive weeks were found to be 88.1, 88.3, 89.0 and 88.4 per cent. respectively, an average of 88.5 per cent. for the whole period and a difference of less than 1 per cent. between the maximum and minimum figures.

While the order of the figures indicates a comparatively high efficiency for the process the importance of maintaining the maximum figure cannot be emphasised too strongly, especially for the large factory where large amounts of products are involved. This point will be referred to later.

Laboratory Equipment.

While it is not proposed to give a complete list of the chemical apparatus required for the laboratory, since the amount would depend both on the size of the factory and the extent to which control is to be carried out, the following list, comprising the majority of the more important items, may be of interest.

Apparatus.

1. Analytical balance, 200 grammes, sensitive to 1 milligramme.
2. Analytical weights from 100 grammes to 1 milligramme.
3. Rough balance (Beranger system) 1000 grammes, sensitive to 1 gramme.
4. Box of weights from 500 grammes to 1 gramme.
5. Laboratory scales, 10 kilogrammes, sensitive to 10 grammes.
6. Box of weights from 5 kilogrammes to 1 gramme.
7. Steam oven, with 3 compartments, each compartment approximately 8 ins. x 8 ins. x 8 ins. and fitted with a shelf.
8. Steam bath. The holes in the cover should be fitted with sets of rings.
9. Drying oven for electric heating for temperature not exceeding 120°C. Size of oven 12 ins. x 10 ins. x 10 ins. and to be fitted with a shelf.
10. Iron stands with clamps and rings of various sizes.
11. Evaporating basins, round bottomed, 6 ins. and 4 ins. diameter.
12. Soxhlet extractors, complete with flasks and condensers, capacity of extraction flasks 200 c.c. and 120 c.c. respectively.
13. Extraction thimbles.
14. Filter funnels, 2 ins., 4 ins. and 6 ins. diameter.
15. Filter paper to fit.
16. Filter stands.
17. Porcelain pestles and mortars 4 inch and 6 inch diameter.
18. Wide mouthed flat-bottomed flasks for weighing residual oil, capacity of flask 200 c.c.
19. Measuring cylinders, 250 c.c., 100 c.c., 50 c.c., 25 c.c.
20. Desiccators, 10 ins. diameter.
21. Evaporating basins, flat bottomed for drying oil, 3 ins. and 4 ins. diameter.
22. Glass beakers, 250 c.c. capacity.
24. Gooch crucibles, capacity 10 c.c. with holder and rubber ring to fit.
25. Pressure flask with length of rubber tubing.
26. Water pump.
27. Burette, 50 c.c.
28. Burette stand.
29. White porcelain tile.
30. Dropping bottle for phenol phthalein solution.
31. Distilling flasks, 500 c.c.
32. Glass condensers (Liebig type) 18 inch jacket.
33. Rubber tubing.
34. Pipettes 100 c.c., 50 c.c., 25 c.c., 5 c.c. glass rod, glass tubing, corks, cork borers, files, scissors, scalpels and other similar accessories.

Chemicals.

1. Petroleum ether (B.P. 60°—80°C.)
2. Alcohol (95 per cent.)
3. Phenol phthalein solution.
4. Decinormal caustic potash solution.
5. Decinormal sulphuric acid for standardising caustic potash solution.
6. Calcium chloride.

Apart therefore from the building itself, the fitting up of the laboratory necessitates a considerable capital outlay, while, on account of the large proportion of glassware among the apparatus, the liability to breakage must not be overlooked.

A rough estimate for apparatus and chemicals places the original cost, even for a small laboratory, at approximately \$1,200.

As regards the laboratory, arrangements would have to be made for water, steam and electricity supplies. The provision of these services would not present any difficulty in view of the requirements of the factory in these directions.

Conclusions.

It will be realised from the foregoing account that even a simple system of factory control, such as that outlined, is only feasible for large oil palm factories, from which the output of products is sufficiently great to warrant the necessary expenditure.

It is obviously unreasonable to suggest the introduction of the system for an estate of 1000 acres or even 2000 acres. The only method by which estates of this size could engage in factory control would be by joining with other estates in the erection and equipping of a central laboratory; even then it is doubtful whether the expenditure would be justified, more particularly in view of the relatively small output of products.

In the case of small estates the present system, namely the correlation of bunch or fruit weight with that of oil, is probably sufficient, bearing in mind that the optimum conditions for each individual stage of the process have been worked out and published (1) (2). If, therefore, estates maintain these conditions it is reasonable to suppose that their yields of products, in addition to showing only very small variation, should also be approximately maximum figures. For example, at Serdang, using the centrifugal extraction process, the average weekly oil recovery for the first four months of the present year was 26.4 per cent., the maximum figure being 26.8 per cent. and the minimum 26.0 per cent. These figures are based on the weight of the fruit as delivered to the factory, the fruit containing approximately 10 per cent. of trash.

Large estates, for example 5,000 acres or more, in which the annual output of products is much greater are in a different category. For an estate of 10,000 acres in full bearing, calculations show that, allowing annual outputs of

16 cwt. of oil and 4 cwt. of kernel per acre and prices of £18 per ton for oil and £8 per ton for kernels, the annual value of the products is approximately \$1,400,000. A variation of only one half per cent. in the output of palm oil alone is equivalent to a difference of over \$6,000 per annum, an amount which might reasonably be expected to cover the greater part of the cost of the annual upkeep of the factory laboratory and for the expenditure of which the estate would also have the additional chance of ensuring the maximum revenue from its factory as a result of the introduction of an efficient system for the control of losses of products.

References.

- (1) Georgi, C. D. V., The Centrifugal Extraction of Palm Oil at Serdang; *Malayan Agricultural Journal*, Vol. XX, No. 9, September 1932, page 446.
 - (2) Georgi, C. D. V., A Comparison of the Press and Centrifugal Methods for Treatment of Oil Palm Fruit. *Malayan Agricultural Journal*, Vol. XXI, No. 3, March 1933, page 103.
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APPENDIX 1.

FACTORY CONTROL STATEMENT FOR.....ESTATE

DATE.....

1. *Record of Weights and Volumes of Products.*

	lbs.
Weight of fruit bunches	_____
Weight of bunch residue	
Weight of threshing machine waste	
Weight of sterilised fruit	
Weight of pericarp residue	
Weight of clean nuts from screen	
Weight of palm oil	_____
Weight of palm kernels	_____
	gallons
Volume of condensed water from sterilisers	
Volume of waste water from oil-washing tanks	
Volume of waste water from sludge recovery plant	

2. *Bunch Sterilisation Statement.*

	lbs.
Weight of fruit bunches	_____
	lbs. per cent.
Weight of bunch residue	
Weight of threshing machine waste	
Weight of sterilised fruit	
Loss in weight (by difference)	_____
	100.0

Note :—The approximate amount of steam consumed in sterilising the above weight of fruit bunches can be obtained by subtracting the loss in weight from the weight of condensed water from the sterilisers. The latter figure is obtained by multiplying the volume in gallons by ten, thereby converting to pounds of water.

3. *Bunch Residue Statement.*

	lbs.
Weight of bunch residue	a
Weight of sterilised fruit	b

$$\text{Proportion of sterilised fruit} = \frac{b \times 100}{a} \text{ per cent.}$$

4. *Results of Analysis.*

	Moisture per cent.	Oil per cent.	Oil (on dry basis) per cent.
Cleaned bunch residue		x	
Threshing machine waste	x	x	x
Pericarp residue	x	x	x
Clean nuts from screen		x	
			lbs. per gallon.
Condensed water from sterilisers			x
Waste water from oil washing tanks			x
Waste water from sludge recovery plant			x

Note :—An x indicates the extent of the analysis required.

5. *Losses of Palm Oil.*

	lbs.
Condensed water from sterilisers	
Cleaned bunch residue	
Sterilised fruit in bunch residue *	
Threshing machine waste	
Pericarp residue	
Clean nuts from screen	
Waste water from oil-washing tanks	
Waste water from sludge recovery plant	

These figures are all calculated by multiplying the weight or volume of the product by its oil content.

Total

* See Section 6.

6. *Final Distribution of Palm Oil and Efficiency of Process.*

Knowing the weight of the oil recovered from a given weight of fruit bunches or sterilised fruit the distribution of the oil at the different stages of the process can be calculated as percentages of the total weight of oil originally present. The latter figure is obtained by adding together the weight of oil recovered and the sum total of the various losses of oil cf. 5.

The figure for the amount of "Oil recovered" in the column headed "Percentage of Total Oil" is usually referred to as the "Percentage Efficiency", representing the proportion of oil recovered to the total amount of oil taken as 100 per cent.

The percentage oil content of the fruit bunches or of the sterilised fruit can be calculated by multiplying the weight of oil by 100 and dividing by the weight of material involved.

Stage of Process	Weight of Bunches lbs.		Weight of Sterilised Fruit lbs.	
	Distribution of Oil lbs.	Percentage of Total Oil	Distribution of Oil lbs.	Percentage of Total Oil
Condensed water from sterilisers (loss) ...				
Cleaned bunch residue (loss) ...				
Sterilised fruit in bunch residue (loss) ...				
Threshing machine waste (loss)				
Pericarp residue (loss) ...				
Clean nuts from screen (loss) ...				
Waste water from oil-washing tanks (loss) ...				
Waste water from sludge recovery plant (loss) ...				
Oil recovered ...				
Total Oil ...		100.0		100.0

Calculated oil content of fruit bunches = per cent.

Calculated oil content of sterilised fruit = per cent.

Note :—There will be no entries in the first four columns under the heading "Weight of Sterilised Fruit".

7. *Palm Kernel Recovery Statement.*

	lbs.
Weight of fruit bunches	_____
Weight of sterilised fruit	_____
Weight of palm kernels	_____
	per cent.
Recovery of palm kernels (calculated on fruit bunches)	
Recovery of palm kernels (calculated on sterilised fruit)	

8. *Analysis of Palm Oil.* per cent.

Moisture
Dirt
Acidity (calculated as palmitic acid)

9. *Analysis of Palm Kernels.* per cent.

Shell and Dirt
Moisture
Oil

GINGELLY

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Introductory.

In view of the attention given at present to annual crops for Asiatic small-holders, it is thought opportune to give a short account of gingelly and its cultivation in Malaya. This crop has been cultivated with success from time to time on Government Experimental Plantations over a period of many years and information has been published on several occasions (1), (2), (3).

The greatest interest shown in this crop is by Southern Indians, since gingelly is cultivated extensively in Madras. In Malaya, gingelly oil is commonly used by the Indian population, whereas coconut oil is employed by Malays and groundnut oil by Chinese.

Description.

Gingelly, sesame or til, *Sesamum indicum*, is known to the Malays as 'bijan' or 'linga' and to the Tamils as 'ellu'. It is an annual erect herb growing to a height of from two feet to as much as six feet, according to the fertility of the soil in which it is grown.

The flowers are usually borne singly on short pedicels in the axils of the leaves; the corolla being white or pink in colour according to the variety and in shape not unlike the foxglove. The seed capsules are pubescent, green, turning brown when fully ripe and splitting at the apex to liberate the white or black seeds. The seeds are small, ovoid, and flattened, and there are in the neighbourhood of 200,000 seeds to the pound.

The two principal varieties of *Sesamum indicum* are white and black according to the colour of the seeds. There are, however, a number of other varieties with seeds ranging in colour from dark brown to almost red. The black seeded variety is a more robust plant than the white.

Gingelly is commonly cultivated in India and, to a smaller extent, in other parts of the tropics and sub-tropics, such as Japan, China, Abyssinia, East Africa, and Palestine. The crop is grown for its seeds which yield from 40 to 50 per cent. of a clear yellow or light brown oil which is extensively used by Indians for culinary purposes and anointing the body. Gingelly seeds are imported into Europe, mainly Marseilles, where the oil is extracted and used in salad oils as well as for other purposes.

Imports.

Large quantities of the seeds are imported into Malaya annually; the oil is expressed locally and used largely by Indians; the residual cake or "poonac" is used as a cattle food. Owing to the large reduction in the Tamil population on estates in Malaya, consumption has declined considerably recently. Imports of gingelly seed and oil into Malaya for the year 1932 obtained from official returns, are shown in the following table :—

Net imports of gingelly seed and oil into Malaya, 1932.

Commodity.	Quantity.	Value.
Gingelly seed ...	2,708 tons.	\$326,286
Gingelly oil ...	220 cwts.	\$ 3,835

Re-exports were 152 tons seed and 338 cwts. oil, which are not included in the above figures.

Assuming that gingelly is grown as a rotation with other crops, and occupied the same land once during the year, approximately 10,000 acres would be required to replace the net imports into Malaya during 1932. This area is based on an average yield of 600 lbs. of cleaned seed per acre.

Import Duties.—The following duties on gingelly oil imported into the Federated Malay States have been imposed by the Federated Malay States Government, vide Gazette Notification No. 2440 of 31.3.1933 —

Edible Oils and Fats :

Gingelly oil, per pound, 4 cents full duty, 2 cents preferential duty.

Soils and Cultivation.

In India it is said that gingelly is grown on nearly all kinds of soil, ranging from the rather poor types to the rich delta lands. It is cultivated as an intermediate crop between padi seasons when the rainfall is favourable, and also mixed with such crops as cotton and sorghum (*Andropogon Sorghum*). In Malaya, it has been found that gingelly can be grown with success on both sandy and clay loams, as well as on heavy alluvial clay soils, providing they are well drained and a good surface tilth can be obtained. It does not grow well on poor soils that have been subject to erosion, and it has been found that, on acid soils, the crop is poor unless lime is applied. To obtain remunerative crops it is essential that the soil should be well supplied with humus and available plant foods.

The land should be well cultivated to a depth of five or six inches and the surface soil brought to a fine tilth. This may be accomplished with ploughs and harrows, or by manual labour, but, as the crop is one which has to be produced cheaply, the former methods are an advantage where the crop is grown on a large scale.

The seeds may be sown broadcast at the rate of four or five pounds per acre and harrowed in, or in drills eighteen inches apart. It is advisable to mix the seed with three or four times its bulk of dry sand or wood ashes, to facilitate even distribution, and to prevent the seeds being sown too thickly.

In Malaya, the best time for sowing is March or April and October or November, so that the crop is well supplied with moisture during the growing period, and the crop can be harvested in comparatively dry weather.

Fresh seeds germinate in a few days after sowing and, in about three weeks, the seedlings are large enough to be thinned. If the seeds are sown in drills, thinning, and also weeding, is more easily carried out than when they are sown broadcast. While thinning, weeds should be thoroughly eradicated when, unless weeds are particularly troublesome, no more attention will be required until the crop is ready to harvest. The plants commence to flower in four to five weeks after germination of the seed, and the crop is ready to harvest within a further two months.

Harvesting

Harvesting should be undertaken when the majority of the leaves have dropped and the first few seed capsules are seen to be bursting. At this time most of the capsules will be green, but it is inadvisable to leave the crop too long in the field otherwise there will be considerable loss of seed.

Harvesting is performed by cutting the plants, tying them in bundles, and transporting them to an open shed with a hard clean floor. Here they should be stacked in heaps with the tops of the plants pointing inwards. They may be left in small heaps for a few days while a certain amount of heat is generated, and the stems and seed capsules turn brown. If the temperature of the stack rises too high it is advisable to turn it once or twice. The crop should then be laid out on a clean floor in the sun to dry. The capsules will burst, and the seeds can be threshed out by beating with sticks. The stems and other trash are removed, and the seeds swept into heaps and winnowed. The clean seeds should be well dried before they are stored.

Should cement floors not be available for stacking and cleaning the crop, an excellent floor for the purpose can be made by levelling the soil, beating it hard, and smearing the surface with cattle droppings. When dry, the surface of this floor can be swept clean. It is essential to have a hard clean floor otherwise there will be difficulty in obtaining seeds and there will also be loss of crop.

Should the weather be dry during the time of harvest, the stack may be made in the open, and covered at night to prevent it becoming damp from dew. It is not often, however, that the weather can be relied upon to remain dry at the time required, and it is advisable to have a floor prepared under cover as well as in the open.

Yields.

The yields of gingelly seed vary with the soil and conditions under which the crop is grown.

Crops of gingelly have been grown on a number of occasions by the Department of Agriculture.

The results obtained are shown in tabular form below :—

Gingelly grown on Government Plantations.

Situation.	Soil.	Actual yield.	Calculated yield per acre.
(1) Castleton Estate, Teluk Anson. Intercrop with coconuts.	Heavy alluvial clay.	1,122 lbs. from 1.85 acres.	600 lbs.
(2) Experimental Plantation, Serdang. Sole crop.	Sandy clay loam with cattle manure.	85 lbs. from 1/10 acre plot	850 lbs. (black-seeded variety).
(3) Experimental Plantation, Serdang. Sole crop.	Sandy clay loam with cattle manure.	65 lbs. from 1/10 acre plot	650 lbs. (white-seeded variety).
(4) Experimental Plantation, Serdang. Sole crop.	Sandy clay loam with artificial fertilizer.	35 lbs. from 1/20 acre plot	700 lbs. (white-seeded variety).
(5) Experimental Plantation, Serdang. Sole crop.	Sandy clay loam with cattle manure.	50 lbs. from 1/20 acre plot	1,000 lbs. (white-seeded variety).

The plots numbered 2 to 5 may be described as good average land that had not suffered from erosion.

At the Experimental Plantation, Serdang, a crop of gingelly has recently been harvested (February, 1933) from an area of five acres, where it is grown as an indicator crop in a Soil Reconditioning Experiment. This consisted of manuring and growing green manure crops which were incorporated in the land.

The soil is of the valley quartzite type of very low fertility, as it has been under cultivation since 1924, when the land was cleared of secondary jungle. It should be noted that, previous to the application of manure in 1931, practically nothing would grow on this soil.

By the use of liberal dressings of cattle manure, artificial fertilizers and lime, it was found possible to grow a heavy crop of *Centrosema pubescens* which was dug into the soil during the latter part of 1932. Crops of 800 to 900 lbs. of dry gingelly seed per acre were harvested from these plots whereas, on land with artificial fertilizers only and a small crop of *Centrosema* dug in, yields averaging only 100 lbs. seed per acre were obtained. This experiment demonstrates clearly that soil of good fertility is essential to secure satisfactory crops. Furthermore, it must be emphasized that, owing to the small monetary return from a crop of this nature, it is necessary to select fertile land, since additional expenditure as a result of manuring is uneconomic.

On virgin land opened from jungle, or land kept in condition by the employment of a good cover crop, yields of 600 lbs. of clean seed per acre may be expected.

With a yield of $4\frac{1}{2}$ piculs of seed per acre selling at \$6 per picul, the return is \$27. It is obvious that this low return will not permit of any profit being made with paid labour, unless grown in rotation with a more remunerative crop. As a rotation crop grown by the small-holder himself, gingelly has possibilities, since there is a considerable local demand and the crop occupies the land for three months only.

Local Extraction of Oil.

Gingelly oil is extracted by Indians in the vicinity of the majority of the large towns in Malaya. The usual method of extraction is by a locally made wooden pestle and mortar, the oil being removed by pressure between the pestle and mortar produced by a slowly revolving, heavily weighted pole. A pair of bullocks are employed to propel the machine, known as a "cheku". The wooden mortar, which is made of local hard-wood, lasts 3 to 5 years. The opposite end of the hard-wood can be utilised when the original mortar is worn out. The pestle lasts for 2 to 3 months only.

The mortar is charged with 7 gantangs (1 gantang = 6 lbs.) of seed and the machine is kept rotating for about two hours, when the operation is complete. The average quantity of oil extracted is about 14 katties, together with a residuc of 18 to 20 katties of oil cake or poonac. With good bullocks four charges are dealt with in a day. Two men undertake the work, one man in charge of the bullocks and the other attending to the collection of oil from the mortar. A small quantity of brown sugar is commonly added to each charge of seed.

Gingelly seed is imported from India after the dry season and at other times from Java and Siam. Present prices are (May, 1933)—seed \$6 per picul; oil, \$15 per picul; and poonac \$4 per picul.

In Kuala Lumpur, recently, a mechanical plant of four oil extractors was examined. The machines, of European manufacture, were stated to have been imported from India. The design is based on the ordinary "cheku" previously described. The plant was driven by a 15 B.H.P. electric motor. This factory is capable of dealing with 10 piculs of seed per day yielding a return of $3\frac{1}{2}$ piculs of oil and $6\frac{1}{2}$ piculs of poonac.

Conclusions.

Considerable quantities of gingelly seed are imported annually into Malaya for the local extraction of oil and cake. Recent imports duties on the oil into the Federated Malay States favour the local oil expression industry.

Under average conditions gingelly grows well in this country, and since it matures in just over three months from sowing, it is a suitable rotation crop for the small-holder. Yields average four and a half piculs of dried seed per acre. The seed is readily extracted from the capsules by hand. There is a considerable demand for seed for the local extraction of oil and no difficulty is experienced in disposing of the crop produced.

References.

- (1) Liming Experiments, *Agricultural Bulletin*, F.M.S., Vol. IV, 1916, page 378.
 - (2) Local Production of Gingelly as a Catch Crop, *Malayan Agricultural Journal*, Vol. X, 1922, page 94.
 - (3) Guide to the Government Experimental Plantation, Serdang, F.M.S., 1931, page 16.
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Selected Article.

MARKET REQUIREMENTS.*

R. H. Horne.

In considering market requirements and attempting to give any guidance in meeting them, it has to be remembered that the Tea Trade is an old and conservative institution. Certain demands have been created during years of trading; a certain type of tea has been established in particular countries, or even districts and has remained in favour for years. It is, therefore, obvious that any attempt on the part of producers to force a particular type of tea on the Trade is likely to meet with failure. The manufacturer of tea has to cater for his market, in the same way as any other manufacturer.

The Tea Trade, however, is not selling to one particular community, nor filling one particular demand. Tea now goes to every quarter of the globe and it is therefore not surprising that there is a great variety of demands; what may be an excellent tea for one country or district may be unsuitable for another. There are, however, generally accepted universal standards for tea, which, with an occasional exception, rule the prices of tea.

These standards can be roughly classified into the desirable and undesirable qualities. The desirable qualities are good, black, well twisted leaf, tip, even grades, quality, colour, strength and flavour; all to be aimed for when obtainable. The undesirable qualities are naturally their antitheses; poor leaf, stalk, thin liquor, taints, etc.

Few teas can be expected to combine all the good qualities and where some of these factors cannot be expected it is advisable to concentrate on the remainder. Thus, on a low-elevation estate, where it is impossible to obtain quality and flavour, it is essential to aim for colour and strength, with good appearance; such aids to flavour as rapid and hard wither and light fermentation are best left alone.

For medium and high-elevation estates, excepting those above say 4,000 feet, the problem of whether to go for quality and flavour or strength and colour is a difficult one. Each estate must be ruled by local conditions and by the price it commands.

Where prices are consistently good in comparison with neighbouring estates, the teas are probably supplying a particular market demand, and to make an alteration would be a dangerous gamble. In cases such as these, it does not follow that an improvement in the tea from a general standard would result in improved prices, as it may mean the loss of an established market. It is an unfortunate fact that realized prices are not always strictly relative to the accepted ideas of merit.

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The problem therefore, which confronts the Superintendents and Agents of these estates is whether to aim for quality, or colour and strength, or a judicious combination of all. Superintendents may have been told that their teas lack quality and colour. This criticism is not of much assistance, as apart from correcting definite faults in manufacture, it may not be possible to increase both quality and colour in the particular type of leaf coming into the factory for manufacture. A more helpful report would be that the teas are poor in quality and colour, and that one or the other should be aimed for in a greater degree. The best way of deciding the point is to experiment with two contrasting forms of manufacture.

With medium and medium high grown estates, on the average, only three or four months of the year are favourable for the production of flavoury teas, and somewhere between 60 to 65 per cent. of the crop is produced during the non-flavour periods. Therefore, under normal market conditions, the safest course for these estates is to make useful coloury teas with as much quality and "sweetness" as possible. Raw greenness should be studiously avoided. Greenness in the infusions is not a fault, as long as it is not a dull greenness. Greenness in the liquors is an undesirable feature, unless it is accompanied by flavour or pungency, of which it is often an essential adjunct.

Whatever the elevation of an estate, good appearance is of some value, and in low and low-medium estates is of importance.

The preservation of tip is an art which has largely been lost sight of. Tip, particularly in teas from lower elevations, is a distinct asset. The usual receipt for the production of tip is light rolling for the early dhools, but probably as much tip is lost owing to hard sifting and faulty firing as is ever conserved by a light rolling programme.

Probably the greatest factor dividing market requirements is that of grading. However good the value and attractive the quality offered in say, pekoes, a blender using B.O.P.'s in his packets will not change his buying, and under opposite conditions the same applies to a buyer selling a leaf blend. Therefore an increase in the sale of broken blends without a corresponding increase in leaf blends creates a relative stronger market for broken grades. This varying demand can be catered for, but the tendency has been if anything, to make too many changes in endeavouring to meet these demands, resulting in a glut of a particular grade. Very often satisfactory prices for a particular grade have led to an increase in the percentage of that grade, with a consequent lowering of the standard. Quite recently this has been illustrated in the production of excessively large percentage of B.O.P.'s. As the market then had too many B.O.P.'s with a doubtful right to the title and as there was a consequent reduction in the quantity of the true grade B.O.P.'s, the latter were the grades to benefit most by the change.

The question of percentage of grades is chiefly an economic one. While considerable change can be made in grading by altered sifting and cutting, this method can only increase the percentage of a grade at the expense of the standard of that grade or of some other grade. Frequently, however, general improvement in grade percentage can be achieved in the rolling room.

Turning once more to the question of liquors, conditions in Ceylon are such that in favourable weather, medium-elevation estates produce better quality than the high-elevation estates can turn out during the monsoon months. In spite of this large seasonal variation in quality, the majority of estates maintain a constant system of manufacture throughout the year, and a Dimbula estate may be discovered aiming for quality and flavour during heavy monsoon weather and a Dolosbage place, during a cold and dry February, concentrating on colour and strength. Under such conditions the best is not being got out of the leaf.

While teas sell well all the year round, they are probably filling a special market demand, and no variation in manufacture is necessary or desirable. In other cases, however, where teas are selling strictly on their merits, judicious variation of manufacture to suit natural conditions is called for.

The alteration of manufacture, however, necessitates great care, and again market requirements are worthy of study. Good quality may be obtainable, but the question arises for a medium estate, is it worth losing colour for quality? This depends on both the amount of quality and the market demand. Unless some idea of the degree of quality can be conveyed to someone who is in touch with the market, the most desirable type of manufacture may be missed.

A fact that is not generally recognised in Ceylon is that the quality of the Indian and Java crop has a bearing on the demand for Ceylon tea. A good quality Indian season may mean a poorer demand for flavoury and pungent Dimbula and Uva teas. A thin and "rainy" crop from India will probably make for a good market for coloury Ceylon tea. These are points which chiefly affect estates selling in London, and advice should be sought in that centre.

To produce the best type of tea to suit requirements, and in consequence to realise the best prices, is only possible by the closest co-operation between the Superintendent and his Agent. The average stereotyped report is admittedly of little assistance in determining any necessary alterations in manufacture, but is not as a rule intended to indicate the necessity for such a change. If there appears to be a definite fault in manufacture, this would be commented on separately. If a change in manufacture is considered necessary, this is a matter of some moment and would be the subject of a special letter or comment. The next step would then be experimental manufacture.

While it is easy for the tasters to say where a tea is undesirable, it is difficult for him to say what is wanted, and at the same time to make reasonable allowance for what is unattainable. All teas, even the best, would be improved if they had more colour, quality, flavour and better appearance, provided the

increase of one did not diminish some other. Undoubtedly the best way is for the Superintendent to send samples of various different systems, accompanied by full details of conditions of manufacture. The latter is important, as without them, both the samples and the resulting report may be misleading.

One word regarding experiments and experimental samples. The experiment should be very carefully carried out and as a rule only one change should be undertaken at a time. The leaf used should not only be leaf taken into the factory at the same time, but should also be bulked before withering. Every step of the manufacture should be identical except the one alteration. Firing presents a difficulty in this connection, and if two dryers of the same make are not available, it is best to load the trays of a dryer alternately with standard and experimental manufacture, taking care to "tab" each load. Any Superintendent who has personally undertaken an experiment of this nature will realise how important personal supervision is even to the final stage of sealing and marking samples, particularly the latter. Tasting samples should be at least a quarter of a pound each.

The variation of manufacture to suit market requirements is undoubtedly frequently necessary, but should on no account be undertaken without definite information of the type required from a well-informed quarter and certainty that the required standard can be attained.

Miscellaneous Articles.

THE INTER-DEPARTMENTAL AGRICULTURAL CONFERENCE, 1933

The annual Inter-Departmental Agricultural Conference was held for the fourth year in succession in Kuala Lumpur from the 8th to 12th of August.

As compared with that held in the preceding year this Conference was on a smaller scale, comprising as it did only members of the Department of Agriculture and the Co-operative Societies Department, with attendance by officers of the Rubber Research Institute and the Veterinary Surgeon, Selangor, at special sessions on subjects which were of particular interest to them.

In a preliminary address in which he invited the Hon'ble Mr. T. S. Adams, British Resident, Selangor, to open the conference, Dr. H. A. Tempany, C.B.E., Director of Agriculture, S.S. & F.M.S. pointed out the great utility of such Conferences, allowing as they do for the discussion of agricultural problems and the formation of plans for the furthering of the policy of the Department. He stated that at the present time the main points of the Departmental policy may be summarised as follows:—

- a. The extension of areas under crops other than rubber;
- b. The introduction of new crops;
- c. The improvement of agricultural products and their manufacturing processes;
- d. Protection against pests and diseases;
- e. Improvement of marketing facilities for peasant produce coupled with the financing of peasant agriculture;
- f. The necessity for a more progressive and better informed outlook on agricultural matters in the minds of the peasantry.

The Conference was formally opened by the Hon'ble Mr. T. S. Adams, who stressed the importance for agricultural field workers of the study and understanding of the psychology of the peasantry.

The sessions on the first, second, fourth and fifth days, which were concerned particularly with the field problems of agricultural crops, were under the Chairmanship of the Director of Agriculture.

Mr. R. Boyd, Director of Co-operation, took the chair on the third day and a portion of the succeeding day when co-operative marketing problems and the use of the Rural Lecture Caravan for propaganda were discussed.

A brief resumé is given below of some of the more important points under discussion at the Conference.

- Padi*.—1. Standardisation of methods for (a) preliminary selection from local varieties of strains of padi for critical comparative trials at Selection Stations, (b) lay-out of comparative tests of pure strains at Test Stations, (c) nomenclature of strains under trial and of pure strains selected for distribution.
2. Departmental experiments on padi manuring and cultivation.

3. Milling problems—(a) Need for facilities where surplus padi is available, (b) need for uniformity of grain wherever padi is produced for milling, (c) need for milling tests on pure strains before they are chosen for distribution.
4. Improvement of padi competitions at agricultural shows.
5. Methods of estimating the padi yields of the country.

Copra.—The improvement of small-holders' copra and difficulties connected therewith.

Tobacco.—Recent results of tobacco experiments and steps that may seem desirable to extend tobacco cultivation.

Fruit.—The raising and distribution of planting material.

Rubber.—The Mouldy Rot problem with special reference to control of the disease in small-holdings.

Poultry.—The poultry policy of the Department of Agriculture and its relation to the work of other Departments.

Marketing.—Marketing Groups and their evolution into Co-operative Marketing Societies.

Consideration of any special problems relating to the preparation and marketing of rubber, copra, eggs, arecanuts.

Agricultural Education.—Instructional courses for Malay Officers and others at the School of Agriculture, Serdang.

Miscellaneous.—The work of District Economic Boards; methods of keeping Agricultural Experiment Station records and Agricultural Registers.

Visits paid by the Conference.—One morning during the period of the Conference was devoted to a visit of inspection to the Government Experimental Plantation, Serdang, and one afternoon session was replaced by an expedition to the Klang Coconut Station, the particular object of interest being the improved type of kiln erected by the Agricultural Department and advocated as being specially suitable for use by small-holders.

(H. D. M.)

THE TENTH MALAYAN EXHIBITION.

The Tenth Malayan Exhibition organised by the Malayan Agri-Horticultural Association was held in Kuala Lumpur on August 5th to the 7th. The Show was undoubtedly a great success and in the matter of exhibits and lay-out showed a considerable improvement on the preceding year.

The official return for attendance was 20,527 as compared with 23,177 for 1932. The weather throughout the period was excellent.

The Opening Ceremony.

After a preliminary speech by Mr. F. W. Douglas, President of the Malayan Agri-Horticultural Association, the Exhibition was opened by the Honourable Mr. M. B. Shelley, Chief Secretary, Federated Malay States; the occasion was honoured by the presence of His Highness the Sultan of Selangor, the Raja Muda of Perak and the Raja Muda of Selangor.

The Honourable the Chief Secretary, in his opening speech, referred to the progress which had been made in the matter of broadening the agricultural basis of Malaya and to the noticeable increase in domestic rice production. He stressed the importance of the efforts being made by the Agricultural and Co-operative Departments to improve the quality of peasant produce, which too often tends to fall below the standard set for the best grades in the world's markets, and commented on the successful results already achieved in this direction with native copra. Referring to the subject of estate agriculture he mentioned the attention which is being given to the utilization of rubber latex stating that increased exports of this product are taking place.

He commented on the striking advances made in the oil palm industry and on the possibilities which are said to exist for the development of a local trade in refined and bleached palm oil, which may replace to a certain extent some of the oils and fats which are at present imported into the country.

With reference to the Malayan pineapple industry he stated that measures for the improvement of the industry, which is definitely threatened with serious competition from other countries, had recently received careful consideration from the Government. In 1932 the total value of tinned pineapple exports amounted to \$7,914,567.

He remarked on the development of tea planting on Cameron Highlands and on the generally satisfactory reports made by London tea brokers upon the samples submitted to them. The valuation placed upon these samples indicate that there are grounds for supposing that the teas produced at Cameron Highlands are capable of competing with the average teas of Ceylon and India.

In conclusion the Chief Secretary pointed out that in efforts to broaden the basis of agriculture in a country, Agricultural Shows play an important part. A brief inspection of the exhibits in the Exhibition indicated that as far as variety and range of production was concerned Malaya already evinces a satisfactory degree of breadth, it was in the direction of quality that improvement was needed. He considered that the utility of such Shows in bringing about this improvement was unquestionable.

After the Chief Secretary had declared the Exhibition open Dr. H. A. Tempany, C.B.E., Director of Agriculture, S.S. and F.M.S., proposed a vote of thanks which was seconded by Mr. J. Hands, M.C.H., Vice-President of the Malayan Agri-Horticultural Association.

Sections of the Exhibition.

The Agricultural Sections comprised the following :—

Fruit, Vegetables, Cereals, Oils and Fats, Fibres, Horticulture, Poultry and Pigs.

The Non-Agricultural Sections were :—

Village Industries, Malay Schools, Weaving and Needle Craft, Art, Photography and Trade.

The following Institutes and Government Departments staged special exhibits :—

Department of Agriculture, Rubber Research Institute, Drainage and Irrigation Department, Federated Malay State's Railways, Public Health and Infant Welfare Departments, Posts and Telegraphs, and the Co-operative Societies Department, which also gave displays of educational cinema films in conjunction with the Public Health Department.

Competitive Sections.

The fruit and vegetable sections contained some excellent exhibits, including a very effective display of vegetables grown at the Government Farm Fraser's Hill and at the School of Agriculture, Serdang.

In the section for collections of vegetables from School Gardens, competition was exceptionally keen and some excellent displays were staged, some of the best containing a great variety of well grown vegetables.

The Fraser's Hill Dairy Farm exhibit was awarded a silver medal.

The School of Agriculture exhibit consisted of 28 varieties of vegetables grown by the students and was awarded a special prize of a silver medal.

Village and School Industries.

These sections included exhibits of home-made articles of fibre, wood, cloth, metal, pottery, etc., and contained the following special stalls :—

Selangor : Village handicrafts organised by the Tungku Laksamana. This stall was awarded a first prize for general excellence in the Village Industry Section.

Brunei : Native silverware.

Port Dickson : Malay women weaving mats and baskets of mengkuang.

Kelantan : Sarongs and other Malay handicrafts; this stall was awarded the second prize for this section.

Sultan Idris Training College : Demonstrations of cotton printing, basketry, pottery, stencilling and batik work.

English Schools, Kuala Lumpur : Separate exhibits were staged of the work done by scholars of the Maxwell Road, Pasar Road and Batu Road Schools.

The Kuala Pilah English School exhibited two looms and gave demonstrations of weaving.

The exhibits throughout these sections showed, in the main, a high standard of workmanship and there was no falling off in quality or quantity as compared with preceding years.

Trade Section.

The large number and high standard of the stalls in this section may be taken as a very gratifying indication of an increasing appreciation of the value of an Exhibition of this kind from a commercial point of view.

Machinery, motor cars, petroleum products, rubber goods, tobacco, fertilisers, wireless apparatus, modern barrels, sun helmets, photographic apparatus, and general merchandise, were among the many articles which were attractively displayed.

(H. D. M.)

THE EXHIBITS OF THE DEPARTMENT OF AGRICULTURE, THE CO-OPERATIVE SOCIETIES DEPARTMENT AND THE RUBBER RESEARCH INSTITUTE AT THE TENTH MALAYAN EXHIBITION. THE DEPARTMENT OF AGRICULTURE.

The exhibit staged this year consisted of ten separate stands, each one designed to provide information on a particular agricultural subject and to demonstrate progress made as the result of recent research and field activities.

One of the two main central stands was devoted to lowland tea, tobacco, bleached palm oil and a display to illustrate a new method of vegetative reproduction.

The lowland tea consisted of exhibits of all grades of tea made at the Government Experimental Plantations, Serdang, displayed both in loose form and in packets as sold in Malaya.

Tobacco was the Virginian type, flue cured leaves from both the Serdang Experimental Plantation and the Singapore Pineapple Station being exhibited as well as cut tobacco and cigarettes prepared from each. Cheroots prepared from the Serdang leaves were also displayed. The refined palm oil exhibit showed palm oil at varying stages of the refining process, (a) crude oil, (b) bleached oil, (c) bleached and neutralised oil. Two different methods had been used for bleaching the oil; in the first case hot-air treatment, in the second the same treatment but with the addition of a catalyst which enables the oil to be bleached at a lower temperature.



PROPAGATION OF TEA BY THE ETIOLATION METHOD



CIGARETTE TOBACCO PRODUCED IN MALAYA

The vegetative propagation exhibit was concerned with the etiolation method employed successfully at the East Malling Fruit Station in England and which promises to be equally efficient for a number of tropical crops. Plants of tea from the field were exhibited which had been collar pruned six months previously. Each specimen had produced a number of rooted shoots averaging, in the six months since pruning, about ten for each treated bush. Young plants, being the severed shoots, were exhibited in water, a method of staging which clearly displayed the satisfactory root system that had been induced to develop. On the other central stand were staged specimens of poor and well prepared copra, specimens of a type of kiln recommended by the Department and of a kiln which exhibited many of the faults in construction common to the majority of native kilns. Specimens of oil from well prepared and poor quality copra demonstrated the difference in quality of the oil obtained from the two products.

One of the side stands was devoted to dairying and demonstrated some of the activities of the Department at the Serdang Stock Farm and at Fraser's Hill. Models were staged showing dairying technique and photographs, illustrating the two pure breeds of Friesian and Montgomery and the different types resulting from crosses between them were displayed. A model of the modern byre used at both Serdang and Fraser's Hill was exhibited and charts of bacterial counts made by the Health Department illustrated the purity of the milk retailed from both places.

Recent results obtained from experiments in the manuring of Oil Palms, Pineapples, Padi and Fodder grasses were shown on separate stands. A section of the Oil Palm stand demonstrated the low fertilising value of the waste products from an oil palm factory and emphasised the consequent necessity of studying the cost of transport and distribution of such materials before including them in any manurial programme. Specimens of Guinea grass in pots illustrated the marked response of fodder grasses to the use of basic slag on heavy soil.

On another stand, samples of the grades of tea produced at Tanah Rata Experiment Station, Cameron Highlands, were displayed along with charts showing the comparison between valuations by brokers for this product and the average prices ruling at the same time for Indian, Ceylon, Java, Sumatra and Nyasaland Tea.

Another stand dealt with marketing and grading problems in relation to copra, pineapples and coffee. Samples of small-holders copra prepared on kilns erected on the lines advocated by the Department were contrasted with average samples. Tabulated statements illustrated the profit accruing to the small-holder as the result of preparing his own copra as compared with the return obtained from selling nuts to local copra makers and the extra profit obtained when the copra was prepared on the approved type of kiln.

In the pineapple section, specimens of tinned pineapples were staged for comparison with the ungraded product now exported. The coffee section

demonstrated recent progress that has been made in the production and grading of coffee beans by small-holders in Kuala Langat district of Selangor.

One stand was devoted to the School of Agriculture where photographs of the School and Hostel and its surrounding were exhibited. A film depicting the School and the life and work of the students was shown at regular intervals.

As usual, there was a stand at which publications of the Department were available for sale and distribution.

THE CO-OPERATIVE SOCIETIES DEPARTMENT.

This Department staged one interesting exhibit illustrating the work of the Co-operative Egg Marketing Society which operates under its auspices in Krian. The stall contained a demonstration of methods of grading and of testing eggs by means of "candling".

THE RUBBER RESEARCH INSTITUTE OF MALAYA.

Exhibits from the Rubber Research Institute were staged by the Chemical, Pathological and Soils Divisions.

Chemical Division.

The general object of the exhibits from the Chemical Division was to create interest in the uses of latex and to provide information to producers in regard to treatment of latex for export.

The main stand consisted of an octagonal pyramid one side of which was devoted to special samples of sheet, crepe, blanket and compo grades.

One section was devoted to specimens showing the preservation and concentration of latex illustrating particularly centrifugal treatment of latex in order to remove constituents which cause discoloration of the latex during storage. Concentration of latex by creaming agents was shown in a glass vessel, in which the separation was in progress.

Another section was devoted to various non-caoutchouc constituents of latex—e.g. quebrachitol, lipin, proteins and phosphates, which influence the character and qualities of latex and rubber prepared therefrom.

The method of preparation of quebrachitol was illustrated by means of a flow diagram and samples of the various intermediate partially purified products.

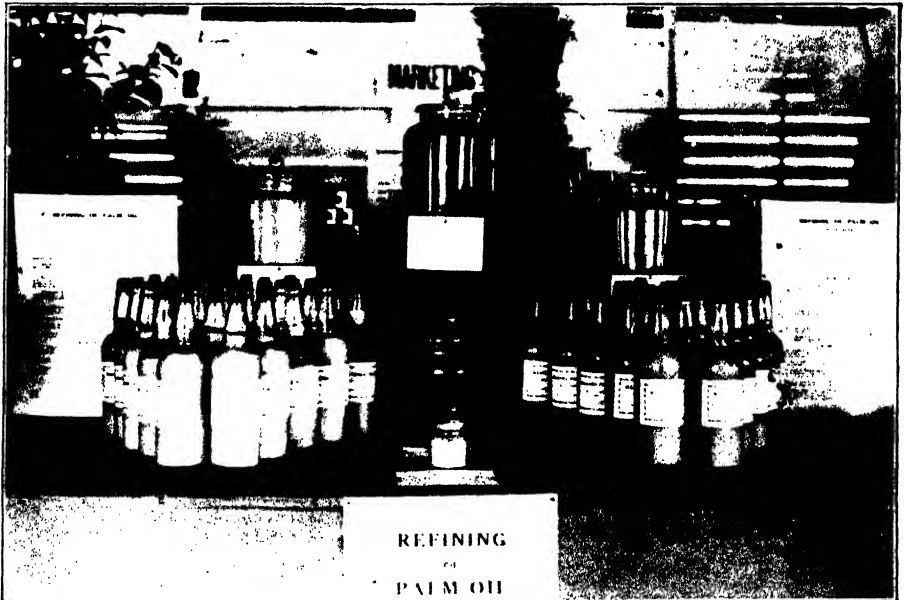
The largest section which attracted most attention, was devoted to manufactured rubber articles including principally a range of products manufactured direct from latex, many of which represented applications to new uses.

The most popular of such exhibits were the "Dunlopilloo" sponge rubber bus cushions and the "Lastex" round rubber thread and bathing costumes containing this thread. One set of the cushions was mounted on a wooden seat so that visitors could test the comfort of this new type of seating, already being adopted extensively in buses in Great Britain.

One other very recent application of rubber to new uses which was also exhibited was the new "Plioform" powder and two articles moulded from this



THE COPRA EXHIBIT



BLEACHED PALM OIL

product which should constitute a new competitor in the plastics field, if the price is favourable.

Several types of firelighters composed entirely of raw rubber or containing raw rubber mixed with other ingredients were also exhibited.

A footpath prepared from the rubber roadway product developed at the Institute was laid in the main Exhibition building.

Pathological Division.

In view of the prominence given earlier in the year to the problem of Leaf Mildew disease, caused by the fungus *Oidium Heveae*, graphs and charts were prepared to illustrate the occurrence and distribution of the disease during 1933.

A plan map was shown indicating the infected localities.

The three principal types of dusting machines imported and used in Malaya viz: the Bjorklund, the Holder Sulphia III and an English machine—the Dustejecta were exhibited, together with explanatory data relating to the operation of sulphur dusting for the treatment of the disease and details of cost and method of operating the various machines.

Photographs of the dusting machines in operation were exhibited showing the formation of a cloud of sulphur dust reaching to the top of trees over 100 feet in height.

Two types of hand dusting machines for use in rubber nurseries and market gardens were also shown.

Charts giving data in regard to cost of dusting were also prepared and exhibited.

Root Diseases. In order that the exhibit should reflect accurately the new points of view in relation to root diseases held by the Pathological Division of the Institute as a result of recent research work carried out at the Institute, a new method of presentation was adopted.

Formerly, before the close affinity of the two principal root diseases—*Fomes lignosus* and *Ganoderma pseudoferrugineum* was suspected, each disease was represented independently.

The system adopted in the present exhibit was arranged to focus attention on the similarities instead of the contrasts between the two diseases and to indicate

- (1) that the two diseases, in relation to origin, development and propagation can be treated collectively,
- (2) that the practical problems in the field are merely variants of a single general problem.

The method adopted to achieve this object were

- (1) the building of the exhibit around the general history of the origin, development and propagation of both diseases,
- (2) incorporating all the diseases in one exhibit, so as to display them “in parallel” instead of “in series”,
- (3) exclusion of abnormal specimens which would distract attention from the main thesis.

The exhibit consisted of a central placard on which the general story of root disease was dealt with in its theoretical and practical aspects together with a series of specimens illustrating the characters of (a) infected jungle timber (as a source of infection), (b) the rhizomorph system (as the vehicle of infection), (c) the wood of infected rubber trees, (d) fructifications and artificial cultures on sterilized wood blocks.

Each phase was illustrated by parallel exhibits of each disease or its causal organism.

Ustulina Zonata:—An exhibit of "Dry Root Rot" caused by the fungus *Ustulina Zonata* was staged separately in order to emphasize the difference of this root and collar rot disease from the two principal root diseases already described. The fact that this disease is a wound parasite and that infection is effected by wind borne spores was emphasized.

Lightning Damage:—Owing to the fact that numerous losses of rubber trees, which were formerly diagnosed as due to the "Die-back fungus", are now known to have been due to lightning strike, an exhibit of specimens, photographs and an annotated plan was staged showing the features of typical lightning damage on a young plantation.

Soils Division Exhibit.

A small but instructive exhibit relating to soil problems included a diagram illustrating the general principles underlying the nutrition of the rubber tree, with explanatory data showing the ill effects of soil erosion and the ameliorative effects of natural undergrowth and also specimens of the more typical natural undergrowths, together with an album of photographs showing desirable and undesirable growths.

A few typical soil monoliths, with analytical data attached, illustrated the principal features of hilly, peaty and coastal clay soils on which rubber is cultivated.

Reviews.

Storage of Rice.

BY

M. KONDO and T. OKAMURA,

“Berichte des Ohara Instituts für Landwirtschaftliche Forschungen”,

Vol. 5, Nos. 2—4, 1932—33.

The authors of this article have carried out experiments on the physical properties, germinating power, chemical composition and vitamin B content of milled rice stored for one, two, three and four years in straw bags in the granary of the Department of Agriculture and Forestry at Kuraschiki, Japan. They showed that during storage the volume—weight, weight of 1,000 grains, water absorbing capacity and swelling capacity decreased and insect infestation increased while grain colour and lustre deteriorated, leading to the conclusion that 2 years was the limit of safe storage of rice in straw bags placed within a well constructed granary.

(These results support those which were derived from a similar experiment conducted in Kuala Lumpur some years ago (*Malayan Agricultural Journal*, Vol. 18, No. 9, 1930) when rice was stored in guni sacks in an experimental grain store).

As regards the germinating power of the rice, the authors found that this deteriorated by 80 per cent. within 1½ years and was almost entirely lost after 2½ years' storage. They found that, provided insects were kept in check, no material changes occurred in the chemical composition of the rice over a period of 4 years. This result has also been confirmed locally. In feeding experiments with fowls it was found that the vitamin B content decreased proportionately with the lapse of time, the loss being 8, 18, 44 and 77 per cent. after 1, 2, 3 and 4 years of storage respectively, while the limit of safety was placed at 2 years storage.

Further the authors show that the rate of decrease in the vitamin B content varied in proportion to the moisture content of the rice; rice containing 12 per cent. moisture losing an inappreciable amount of its vitamin B content in 12 months. They maintain that if the amount of vitamin B content retained by rice having 12 per cent. moisture after 12 months storage is reckoned as 100 then the comparative amounts of vitamin B retained by rice of 14 per cent. and 16 per cent. moisture are respectively 99 and 92 per cent.

Air-dried rice, stored in small containers in Malaya for 4 years, has been found to be practically equal in all its qualities to new rice but the authors of these papers record that air-dried rice stored under airtight conditions for 26

and 28 years was found to have undergone very little change physically or chemically. The vitamin B content was found to be equal to that of rice stored under good ordinary conditions for 2—3 years and, while boiled rice had a slight odour and was not very sticky, yet its taste was fairly good and its culinary characters were quite satisfactory.

This note shows that hulled rice of good quality dried to under 12 per cent. moisture content and packed in airtight containers can be stored safely for approximately 30 years.

H. W. J.

Supply and Marketing of Soybeans and Soybean Products.

BY

STEWART, BURLISON, NORTON and WHALIN,

Bulletin 386,

University of Illinois Agricultural Experiment Station.

This publication contains a detailed history of the growth and development of the cultivation of and trade in soybeans in the United States since 1920 with particular reference to the State of Illinois,—the most important centre in this respect, and gives an account of the increasing importance of soybeans and products in many parts of the world.

The bulletin includes chapters on supply, with reference to competing oils and fats; on consumption; on agricultural practices and on costs of marketing and processing; on inspection and grading; on prices; and on international trade.

It refers to the extending uses of soybean oil, to the value of soybean meal and cake for cattle feeds, soybean flour for use in human foods, and to the cultivation of soybeans for silage or hay.

Reasons for the increase in acreage of soybeans in Illinois have been that farmers "desired to substitute some crop that will take the place of oats in the rotation and be more profitable than oats when grown other than for feed or as a nurse crop", and "the soybean is adaptable as a leguminous catch crop when red clover or another legume in the regular rotation fails to produce a satisfactory stand".

"While labour and power requirements for soybeans are much higher than those for oats or timothy grass, the larger gross returns have been sufficient to pay relatively better for the use of time, equipment, and land", and "soybeans have made possible a cash crop during the year in which they were planted and have

not required the enlargement of livestock enterprises". "Many tenant farmers who, because of lack of equipment or capital, are definitely limited in their livestock enterprises, have found this crop well fitted to the farm plan."

From 1921 to 1927, with low yields and an undeveloped local market, returns from soybeans were insufficient to cover computed costs, but "the development of higher yielding varieties and the improvement in cultural methods have been important factors in increasing both the acre-yields and gross returns" and from 1928 onwards good profits have been made.

Yields have varied considerably—from 10 to 24 bushels per acre—according to the district and from year to year, and, generally speaking, yields below 16 bushels of beans per acre have been unremunerative. The lowest yields are in the southern parts of the State where, however, soybeans are mostly grown for hay.

"A restraining factor influencing the expansion of soybean acreage is that labour requirements for soybeans grown for hay do not fit in well with those for the major crops of the corn belt region, and for soybeans grown as a cash crop these requirements conflict markedly with those of other crops, especially with corn, on many farms."

"Recognition of the adaptabilities and limitations of soybeans with reference to the needs of Illinois agriculture has resulted in giving them a different place in the farming operations in the Southern, Central and Northern parts of the State. The crop is used in the northern part of the State not only for hay but also to some extent, when interplanted with corn, for grazing and ensilage; in the Central division the beans are mainly gathered, and in the Southern areas of the State the crop is used for hay, with a recent trend toward gathering for commercial purposes".

The bulletin is incomplete, however, in that it does not give the reasons for the above adaptations nor does it refer to their relationships to the major crops of the State.

It is noteworthy that the State of Illinois, which is between latitudes 37 and 43 North, is in approximately the same latitudes as Southern Manchuria, Korea, and Japan, whence soybean originated and where they are chiefly grown.

(R. B. J.)

Abstract.

THE POULTRY INDUSTRY OF INDIA.

*Compiled and abstracted from an article by Mr. R. L. Pandey, Secretary,
United Provinces Poultry Association, Lucknow, published in
The Madras Agricultural Journal, Vol. XXI,
No. 5, May, 1933.*

Part I.

India is supposed to be the original home of poultry and it is assumed that the genus *Gallus* originally migrated from this country to other parts of the world, although it is difficult at the present time to trace this migration through all its stages.

Present condition of the industry. The industry as at present conducted by the local peasantry does not flourish. There is no system of improved breeding, feeding, housing etc. Fowls inbred as they please and are bred to supply eggs and table birds without any attention to size or quality. The birds have generally to feed themselves or are fed but scantily by the owners, all that they can expect from them in the majority of cases being a scattering of grain. Under these conditions the vitality of the birds has deteriorated considerably and they have become susceptible to many diseases. Often, whole flocks are wiped out by plague, cholera, ticks and various types of fever. Taking into consideration the circumstances under which it has to exist the indigenous fowl is a hardy bird and is capable of enduring very great hardship, but on account of the treatment it receives, the size and laying capacity have greatly deteriorated.

Species of Fowls found in India. The red jungle fowl is found in abundance in the jungles of Northern India, along with different kinds of pheasants, while the grey jungle fowl, *Gallus Sonneratti*, is found in the Southern Indian jungles. Domestic fowls that are common in India at present can be put under the following heads :—

- (1) Those that resemble the jungle fowl; they seldom exceed 3 to 3½ lb. in weight and are very poor egg producers.
- (2) *Aseels*, the pure-bred game-fowl; this breed is becoming very rare and is found in the hands of only a few breeders.
 - (a) *Ghages*—resembling Aseels are slow maturing good table birds, but very poor layers.
 - (b) *Chittagongs*—so called after the name of that district of Bengal. This is a valuable breed both as regards laying and table qualities.
 - (c) *Karaknath*—The eyes, skin and blood of this breed are all black. This breed is gradually becoming extinct.

(3) Modern Breeds :—

- (a) In this class will be the modern breeds of Europe and America such as *Rhode Island Reds*, *Leghorns*, *Minorcas* etc.
- (b) The crosses between (a) above and the country fowls. These are bigger in size and are better layers.
- (c) In addition to the classes enumerated above there are a number of geese, ducks, turkeys, guinea fowls and various kinds of pheasants.

Among the modern breeds, White Leghorns, Black Minorcas, Rhode Island Reds and Orpingtons are very popular and seem to stand the climate well.

Unfortunately the Central Government has till now done nothing to encourage the industry of poultry farming but of late some of the Provincial Governments have been showing more interest in the matter.

Methods of Marketing. There is no organised system of marketing eggs and fowls; marketing is in the hands of professional dealers, who make house to house collections and transport the produce to market towns. The eggs are sold by number and not by weight.

The average weight of an egg is about 1½ oz. and that of a table-bird generally about 3 to 4 lb. The average production of the country hen is about 40 to 60 eggs, but larger eggs command a slightly higher price. Table birds command prices ranging from 8 to 10d. according to size and demand. The industry is carried on between the peasant-producer on the one hand and the consumer on the other through the agency of a middle man who makes the most profit out of the deal.

Obstacles of the Industry. There are many difficulties hindering rapid development of this valuable industry, such as religious scruples, ignorance and poverty of the peasant, and susceptibility of the poultry to disease.

Part II.

Poultry Breeding in the United Provinces.

For the past 22 years some small effort has been made to effect improvement in Indian poultry. In 1910 an unofficial body was formed styling themselves The Indian Poultry Club. This body has been instrumental in interesting the public in modern pure-bred poultry by holding exhibitions in different parts of the country. The club also publishes a monthly journal "The Indian Poultry Gazette".

As an outcome of this club Sir Hercourt Butler, the late Governor of these Provinces asked his Government in 1919 to finance a small scheme, which would have as its objects: (1) The improvement of poultry in the United Provinces. (2) To popularise the breeding of fowls and (3) to educate the public on the importance of the industry.

Keeping these points in view, two farms were established in 1920—21, one in the Horticultural Gardens Lucknow, and the other at the Government Bovine Depot at Patwa Dangar, near Naini Tal. The object of these farms was:— (1) To demonstrate how poultry farming should be conducted. (2) To foster the breeding of such fowls as would be suitable to the conditions of the country. (3) To provide stock birds and eggs of the improved breeds for distribution throughout the whole Province. (4) To study the suitability and value of poultry foods grown in the country. (5) To study poultry disease as far as possible, and (6) to evolve a breed of fowl which would combine greater production with immunity from disease.

As regards the popularisation of good breeds of poultry and educational work, the following methods were adopted:—(1) Instructive and interesting articles were contributed to important newspapers on the importance of the industry. (2) Lectures were delivered, illustrated by lantern slides and later on by screening a film, on the poultry industry in India, (3) Poultry shows and demonstrations were organised at all important agricultural fairs and exhibitions which take place yearly in the Provinces, and in which the successful exhibitors were, as an encouragement, given prizes of stock birds or cash. (4) Pamphlets and bulletins were issued on poultry keeping free of cost. (5) Training was given to students in poultry keeping on up-to-date and scientific lines. (6) Local Association and Poultry Societies were organised in conjunction with the Co-operative Department. (7) Practical demonstrations were given by running a Railway Poultry Car, or Miniature Farm on wheels, which was fully equipped with up-to-date appliances etc. and which travelled all over the Province. (8) Recently, a monthly Poultry Journal in Urdu was started in which instructive articles are published on various subjects such as diseases, housing, feeding etc. (9) People interested in poultry were enlisted as members from all over the Province. (10) Mutual business transactions were arranged between farmers. In addition to this, thousands of advisory letters were issued and continue to be issued daily.

Success Achieved. Before this Association started, there were few people who understood the importance of the industry. To-day we find that most of the Provincial Governments and Indian States have started poultry breeding operations, and others are contemplating doing so under the ægis of the development Departments.

The Kashmir Government started four farms last year, these farms are being managed by late students of the association and everything is being done on well established lines.

The Government of the Punjab which started work under the direction of the Association some five years ago, have started four more breeding centres each under a Deputy Director of Agriculture.

Two men have been trained for the Government of Baroda State and are now engaged in the poultry work of that State.

Egg production of pedigree stock has been determined and it has been found that their production is more than 3 times that of the country fowl. The crossing of pure-bred poultry with the indigenous stock has resulted in producing a bird much bigger in size and with better laying capacity both in regard to quantity and quality than the country fowl. A brown Leghorn-desi cross pullet was put in the Egg-laying Test conducted by the Association, and laid 61 eggs in 64 days. The control of poultry diseases by sanitary measures has been studied. For example in 1928-29, the best year of the farm, the disease known as "Ranikhet Disease" broke out in India. The poultry stock was decimated and quite a number of farmers were ruined. Numbers of crows which are carriers of the disease died on the farm daily. Fowls on the farm contracted the disease but prompt measures were taken and only 10 birds out of a flock of 1300 died and the carcasses of these were at once destroyed. The saliva of the infected birds was sent to Muktesar for examination and after being tested was found to contain the infective principle of "Ranikhet Disease". Local food stuffs were tested and their suitability as poultry food ascertained and poultry keepers advised accordingly. A suitable breed of fowls has been evolved. This breed combines increased egg production with size and quality, also greater immunity from disease. Some of the birds of this breed are now 5 years old and they still lay quite well, the size of eggs being remarkably good. Both in 1929-30 and 1930-31 the eggs from this breed won first prize in the large white egg class of the All India Poultry Exhibition.

Departmental.

FROM THE DISTRICTS.

The Weather.

On the western side of the Peninsula the weather was on the whole normal for the month, rainfall being somewhat heavier than in July. At Cameron Highlands, however, and in the lowlands adjoining the central portion of the main range rainfall was much above the average, while in Malacca, more especially the coastal area, there was a drought.

In the eastern States of Pahang and Kelantan conditions were unusually dry until the last third of the month when showers fell.

Remarks on Crops

Rubber. The highest and lowest prices in dollars and cents per pikul recorded during the month for small-holders' rubber were—Smoked Sheet \$10 to \$18.50; Unsmoked Sheet \$8 to \$17; Scrap \$2 to \$7. The average Singapore prices recorded for small-holders' rubber were—Smoked Sheet \$15; Unsmoked Sheet \$14 and Scrap \$6, as compared with \$17.50, \$16 and \$7 in July. The Penang prices for Unsmoked Sheet ranged from \$13 to \$15.50 against \$12 to \$18.40 in July.

Reports record a continued increase in the area tapped in spite of the slight fall in price, except in localities where padi planting operations or the fruit harvest were engaging the attention of small-holders. In some localities bark consumption was becoming heavier, mention being made of reversion to super-imposed cuts and to high tapping by means of ladders. In parts of Johore young rubber was being brought into tapping.

The rise in price has led to the slashing or clearing of weeds and undergrowth on a number of holdings.

Under wetter conditions mouldy rot disease has reappeared widely in previously infected districts, but has received more general treatment than in recent months by the application either of approved disinfectants or of tar.

Padi. The price of padi at the Government Rice Mill showed a further slight rise to \$1.80 per pikul. In Kedah also the price rose slightly, varying from \$10 to \$12 per kuncha (160 gantangs). These prices are equivalent respectively to 7¼ cents and 6¼ to 7½ cents a gantang.

Good progress was made with preparation of the land, sowing and planting throughout Kedah, Province Wellesley and Perak. In the Kuala Pilah District of Negri Sembilan planting has been slow, while in the coastal mukims of Malacca it was delayed by drought. In Kelantan the planting of dry padi was completed by the end of the month, but dry weather hindered the preparation of the land for wet padi and the nurseries were suffering from lack of rain. In the coastal districts of Selangor planting operations were commenced. The

planted crop in the inland districts of Selangor, the major portion of Negri Sembilan and in Pahang continued to make good progress, though in parts of the latter State the water supply was somewhat deficient.

Padi pests have not been particularly in evidence, though army worms did some damage to nurseries in Kedah and rats have caused damage to padi in all stages in Johore. Organised rat drives during clearing operations in Province Wellesley and Krian have proved successful as also have the usual methods of rat destruction in Malacca.

Coconuts and Copra. There has been further steady progress in the production by Malays of copra of improved quality. In Province Wellesley one more kiln has been completed and commenced work, while three more are in view. In Krian a large brick kiln of approved type is being built by a Malay who purchases nuts from European estates and contracts with the Irrigation Department for nuts from the palms growing along the canals and drains. In Temerloh District of Pahang the owners of the existing kiln have decided to allocate part of their profits to purchase materials for a brick kiln and two additional approved kilns should be in operation in the near future. The Malay Copra Instructor is touring the river mukims of Pekan District to encourage the installation of one or two kilns in this area. In Kelantan one approved kiln has been erected but is not yet operating.

Malays in Kuala Selangor and Sabak Bernam Districts of Selangor are showing renewed interest in group production because the better quality of the product made by the groups commands a higher price. The sale of copra direct to Penang from Sabak Bernam appears to be a success, since another group of four kilns has recently joined the existing two groups.

Fruit. The mid-year season for the more important fruits, such as durian, mangosteen, rambutan and pulasan was drawing to a close at the end of the month. On the whole crops were satisfactory. It is reported from Johore that good business was done in exports to the Singapore market. The report from Singapore states that large quantities of fruit were harvested in the island, it being estimated that in the middle of the month 16 tons of locally grown fruit were sold in the market daily. These large local supplies are an indication of the increased interest that is being taken in fruit production in Singapore.

Tobacco. Maintenance of the improved price has sustained interest in this crop. In Kedah 54 acres were planted while in Kuala Pilah District the planted area has been increased to 30 acres; new plantings are also reported from Selangor and Johore.

During the month 32 pikuls 26 katis of leaf were sold by growers in Singapore Island to factories in the town. Prices for cured leaf in Province Wellesley were \$22 to \$37; in Taiping \$27 to \$42; prices between \$50 and \$58 were paid for first grade leaf in Southern Perak, Ulu Selangor and Malacca town.

Agricultural Stations.

Preparation of the land for the further planting or supplying of plots of permanent crops has progressed well at Bukit Mertajam. Work on the revised lay-out of the Kuala Lipis Station has been commenced and some planting work has been done on the other three Stations in Pahang. On the Rembau Station maize, ragi, tapioca and various vegetables were harvested; further progress was made in the development of the Kuala Pilah Station. On the Pineapple Station, Singapore, the yield of fruits gradually decreased until only a few were harvested at the end of the month as the season is now over. Growth on all the blocks not yet in bearing was good. The remaining crop of tobacco was harvested and the types other than Virginian were cured with coconut toddy or by burying. Further nursery beds of Virginian varieties were sown.

Padi Stations and Test Plots.

Planting was nearing completion at the Telok Chengai Station in Kedah. At Titi Serong planting operations were in progress, as also at Pulau Gadong where the mechanical cultivation experiments were completed. At the Pasir Puteh Experiment Station in Kelantan the nurseries were sown. Preparation of the land was delayed by drought which necessitated pumping and ploughing on alternative days. Drought also caused difficulties at the Central Farm, Kota Bharu, where cultivation of the wet padi fields was only made possible by the use of the electric pump and of much labour to puddle the land sufficiently to make it hold water. At the Bukit Merah Test Plot the catch crop of tobacco was harvested, nurseries were sown and the land prepared for planting. Work on other Test Plots proceeded normally.

The Director of Agriculture visited Stations and Test Plots in Perak and Province Wellesley during the month.

Agricultural Course for Penghulus.

A course on copra manufacture for Penghulus was held at the Government Coconut Station, Klang, from the 19th to the 22nd August. Instruction was given by the Acting Agricultural Chemist and the Assistant Analyst. The acting Agricultural Field Officer, Selangor, also assisted. Sixteen Penghulus attended and had obtained a good knowledge of this subject at the end of the four days' course.

A short course on the cultivation and selection of padi was given to twenty five other Penghulus by the Agricultural Field Officer, Malacca, at the Pulau Gadong Station from the 19th to the 21st August. All those present showed a keen interest in this subject and many realised for the first time how selected padi strains are obtained and how much work is necessary to produce them.

DEPARTMENTAL NOTES.

Visits and Tours.

The Director of Agriculture, Dr. H. A. Tempany, c.B.E., made an extensive tour of Perak and Province Wellesley, from August 17th. to 26th., visiting Experimental Plots, Agricultural Stations and agricultural undertakings in these territories. He also paid a short visit to Kedah to discuss with the Hon'ble the British Adviser, matters relating to agricultural services in that State.

The Director, accompanied by Mr. E. A. Curtler, Agricultural Field Officer, Cameron Highlands, attended the Conference held by the Incorporated Society of Planters at Taiping on August 19th. and delivered a paper, prepared by himself and Mr. Curtler, entitled "The Cultivation of Tea in the Highland Regions of Malaya".

The Acting Agricultural Chemist, Major C. D. V. Georgi, o.B.E., accompanied by Mr. Gunn Lay Teik, Assistant Analyst, visited Kampong Kuantan on August 23rd. on the occasion of the first shipment of palm oil in bulk by Selangor Bulk Oil Installation Ltd.

Mr. R. A. Altson, Assistant Mycologist, proceeded to Johore on August 23rd. in connection with a disease of oil palms, and returned to Kuala Lumpur on August 30th.

Inter-Departmental Agricultural Conference 1933.

The fourth Inter-Departmental Agricultural Conference was held at the Masonic Hall, Venning Road, Kuala Lumpur, from August 8th. to 12th., and was attended during all sessions, by members of the Field Branch of the Department of Agriculture and on certain days by members of the Co-operative Societies Department and the Rubber Research Institute of Malaya. A brief account of the Conference is published in the present issue of the Journal.

Visitors to Serdang and Klang

H.R.H. Prince Purachatra, who was on a visit to Malaya from Siam, visited the Government Experimental Plantation, Serdang on August 12th. and was conducted around the plantation by the Agriculturist, Mr. Bunting.

On August 22nd. members of the Klang District Rotary Club paid a visit to the Coconut Experimental Station, Klang, where Dr. H. W. Jack, m.B.E., and Mr. Gunn Lay Teik, explained the research work which is being carried out at the Station in connection with cultivation and selection of the coconut palm and demonstrated the working of a kiln suited to the requirements of small-holders. The kiln has been erected for the purpose of demonstrating, to small-holders and others, methods of improving the quality of copra manufactured in Malaya.

Statistical.

MARKET PRICES

August 1933.

Rubber.—The market price for rubber remained fairly steady during the month, opening at 12 1/16 cents per lb. for Spot loose in Singapore and closing at 12 cents. The average price for the month was 12 3/16 cents per lb. in Singapore, 3 13/16 pence in London and 7½ cents Gold in New York as compared with 12 11/16 cents, 3½ pence and 7½ cents Gold respectively in July.

Palm Oil.—The course of the English market during August on a basis of 18 per cent., f.f.a., c.i.f. Liverpool was as follows:—August 3rd £17.5.0 per ton, market easier, 17th August £16.10.0 per ton, market quiet, 24th August £16.15.0 per ton, market steady and August 31st £16.15.0 per ton, market quiet.

Prices in the U.S.A. landed weight per pound in bulk c.i.f. New York/Philadelphia were 3.60 cents Gold on the 4th August; 3.50 cents Gold on the 12th August; 3.30 cents Gold on the 19th; and 3.35 cents Gold on the 26th August.

The price of palm kernels Fair Average Malayan Quality c.i.f. landed weight on the Continent was Shillings 8 per cwt. on the 4th August; Shillings 7/10½ per cwt. on the 12th; Shillings 7/9 per cwt. on the 19th; and Shillings 8 per cwt. on the 26th August.

Copra.—The market during the month has been a fairly steady one. The highest Singapore price for Sundried during August was \$3.80 per picul, and the lowest price \$3.60 per picul, the average price being \$3.70 per picul as compared with \$3.97 during July. The mixed quality averaged \$3.13 per picul as compared with \$3.37 in July.

Coffee.—During the month the price at Singapore for Sourabaya coffee was steady, the prices having fallen compared with July prices. Prices ranged according to grade, from \$16 to \$19 as compared with \$20 to \$22 during July. Palembang coffee averaged \$13.12 during the month having dropped from \$13.50 on the 4th to \$12.50 on the 11th the average figure for July was \$14.60.

Arccanuts.—Palembang's averaged \$2.49 and Bila Whole \$2.37 per picul as compared with \$2.32 and \$2.63 during July. The range of Singapore prices for other grades was:—Split \$2.50 to \$4; Red Whole \$3 to \$4.50, Sliced, \$9 to \$12, Kelantan \$3 to \$3.50.

Gambier.—Block Gambier again increased in price towards the end of the month, the average price being \$4.75 per picul, Cube No. 1 averaged \$8. Corresponding figures for July were:—\$4.37 and \$7.62 respectively.

Pineapples.—Values again firmed slightly during July, the average Singapore price per case being: Cubes \$3.26, Sliced Flat \$3.16, and Sliced Tall \$3.25, as compared with \$3.22, \$3.15, and \$3.39 respectively during July.

Fapioca.—The price of Flake Fair averaged \$3.95 as compared with \$4.20 in July. Pearl Seed averaged \$5 as compared with \$5.19 in July and Pearl Medium averaged \$5 as compared with \$5.31 in the previous month.

Sago.—Pearl—Small Fair as in July remained steady at \$4.50, Flour-Sarawak Fair averaged \$1.83 as compared with \$1.91 in July.

Mace.—Prices ruling during the month were similar to July prices, namely \$70 per picul for Siouw and \$50 for Amboina.

Nutmegs.—There was a further drop in prices during August, Singapore price per picul for 110's was \$20 as compared with \$21.25 in July. 80's averaged \$26.50 having averaged \$29.12 in the previous month.

Pepper.—Average Singapore prices during August were as follows :—Singapore Black \$13.19 per picul, Singapore White \$23.12 and Muntok White \$23.75, the corresponding figures for July were \$14.69, \$26 and \$26.50 respectively.

Cloves.—As previously, the demand for cloves remains small, nominal prices being \$40 for Zanzibar and \$45 per picul for Amboina.

GENERAL RICE SUMMARY.

July, 1933.

Malaya.—Gross foreign imports of rice (including stocks available for re-export) during July 1933, amounted to 50,827 tons, as compared with 50,008 tons in June 1932 of which 54 per cent. were consigned to Singapore, 19 per cent. to Penang, 6 per cent. to Malacca, 14 per cent. to the Federated Malay States and 7 per cent. to the Unfederated Malay States.

Of these imports, 59 per cent. were from Siam, 38 per cent. from Burma, 2 per cent. from Indo-China and 1 per cent. from other countries.

Total foreign exports of rice from Malaya in July 1933 were 13,432 (including 203 tons local production) as compared with 13,924 tons in July 1932.

Of these exports 82 per cent. were consigned to Netherlands India and 18 per cent. to other countries.

Net imports for the period January to July 1933, were 238,066 tons as compared with 235,566 tons during the same period for 1932, a fall of 1 per cent.

India and Burma.—Total foreign exports of rice during June, 1933, were 221,000 tons as compared with 230,000 in the previous month and 182,000 tons in June 1932.

Siam.—Exports (approximate) during July 1933, amounted to 133,769 tons as compared with 101,286 in July 1932.

Netherlands India, Java and Madura.—For the period end of June 1933, the area harvested amounted to 6,825,000 acres, a decrease of 165,000 acres or 2 per cent. as compared with the corresponding period of 1932: the area damaged was 335,000 acres an increase of 64,000 or 24 per cent. as compared with 1932, and additional plantings awaiting harvesting amounted to 2,102,000 acres an increase of 312,000 acres or 17 per cent.

French Indo-China.—Entries of padi at the port of Cholon from January to July 1933, amounted to 77,585 metric tons an increase of 47,001 tons or 6 per cent. as compared with the same period of 1932.

Exports of rice from Saigon for the period January to July 1933 totalled 865,047 tons an increase of 130,255 tons or 18 per cent. as compared with the corresponding period of 1932.

Europe and America.—Quantities of rice shipped from the East were:—

- (a) To Europe for the period January 1st to July 27th, 839,064 tons, a rise of 209,729 tons or 33 per cent. as compared with the corresponding period of 1932.

Of these shipments 53 per cent. were from Burma, 3 per cent. from Japan, 37 per cent. from Saigon, 6 per cent. from Siam and 1 per

cent. from Bengal, as compared with 59 per cent. from Burma, nil per cent. from Japan, 34 per cent. from Saigon, 3 per cent. from Siam, and 4 per cent. from Bengal in 1932.

- (b) To the Levant,—period January 1st to June 17th, 17,121 tons, a fall of 23,869 tons or 58 per cent. as compared with the same period of 1932.
 - (c) To America and the West Indies for the period January 1st to June 25th, 83,968 tons an increase of 13,554 tons or 19 per cent. as compared with the same period of 1932.
-

MALAYA RUBBER STATISTICS

ACREAGES OF TAPPABLE RUBBER NOT TAPPED ON ESTATES OF 100 ACRES AND OVER, FOR THE MONTH ENDING JULY, 1933.

STATE OR TERRITORY (1)	Acreage of Tappable Rubber end 1932 (2)	ESTATES WHICH HAVE ENTIRELY CEASED TAPPING		ESTATES WHICH HAVE PARTLY CEASED TAPPING		Total (3) + (5) (7)	Percentage of (7) to (2) (8)
		Acreage (3)	Percentage of (3) to (2) (4)	Acreage (5)	Percentage of (5) to (2) (6)		
STRAITS SETTLEMENTS:—							
Province Wellesley	44,734	1,447	3.2	8,113	18.1	9,560	21.4
Dindings	6,969	209	3.0	908	13.0	1,117	16.0
Malacca	111,780	5,315	4.8	19,376	17.3	24,691	22.1
Penang Island	1,635	776	47.5	55	3.4	831	50.8
Singapore Island	28,269	10,311	36.5	5,088	18.0	15,399	54.5
Total S.S.	193,387	18,058	9.3	33,540	17.3	51,598	26.7
FEDERATED MALAY STATES:—							
Perak	250,951	8,415	3.4	34,721	13.8	43,136	17.2
Selangor	308,379	10,672	3.5	44,753	14.5	55,425	18.0
Negri Sembilan	228,541	13,858	6.1	20,151	8.8	34,009	14.9
Pahang	38,141	6,957	18.2	5,374	14.1	12,331	32.3
Total F.M.S.	826,012	39,902	4.8	104,999	12.7	144,901	17.5
UNFEDERATED MALAY STATES:—							
Johore	325,747	31,859	9.8	37,836	11.6	69,695	21.4
Kedah (a)	114,551	5,254	4.6	8,984	7.8	14,238	12.4
Kelantan	21,175	6,925	32.7	2,461	11.6	9,386	44.3
Trengganu (b)	4,352	Nil	Nil	2,072	47.6	2,072	47.6
Perlis (a)	957	177	18.5	542	56.6	719	75.1
Total U.M.S.	466,782	44,215	9.5	51,895	11.1	96,110	20.6
Total MALAYA	1,486,181	102,175	6.9	190,434	12.8	292,609	19.7

Notes:— (a) Registered companies only and are rendered quarterly.

(b) Registered companies only.

The above table together with a Summary, was prepared and published by the Statistics Department, S.S. and F.M.S. in August 1933.

**ACREAGES OF TAPPABLE RUBBER OUT OF TAPPING IN
NETHERLANDS INDIA AS AT THE END OF THE MONTHS
OF MARCH, APRIL AND MAY, 1933, RESPECTIVELY.**

MARCH	A		B		Total A & B	
	Totally Ceased	Area in Acres	Partly Ceased	Area in Acres	Estates	Area in Acres
Java and Madura	136	54,226	67	17,021	203	71,247
Outer Provinces	204	70,316	72	40,664	276	110,980
Netherlands India	340	124,542	139	57,685	479	182,227
APRIL						
Java and Madura	140	57,403	63	16,929	203	74,332
Outer Provinces	195	69,587	70	39,070	265	108,657
Netherlands India	335	126,990	133	55,999	468	182,989
MAY						
Java and Madura	131	50,090	60	16,791	191	67,700
Outer Provinces	197	69,372	70	38,623	267	107,995
Netherlands India	328	120,281	130	55,414	458	175,695

The total area out of tapping for March amounts to 18.7 per cent. of the total tappable area at end December 1932.

- do - - do - April - do - 18.8 - do - - do -
- do - - do - May - do - 17.9 - do - - do -

(For March, Authority: Economisch Weekblad, dated 26th May, 1933).

(For April, Authority: Economisch Weekblad, dated 23rd June, 1933).

(For May, Authority: Economisch Weekblad, dated 21st July, 1933).

MALAYAN AGRICULTURAL EXPORTS, JULY, 1933.

PRODUCT.	NET EXPORT IN TONS.				
	Year 1932	Jan-July 1932	Jan-July 1933	July 1932	July 1933
Arecanuts	20,280	14,096	11,921	615	1,308
Coconuts, fresh †	108,123†	74,272†	59,536†	10,485†	10,742†
Coconut oil	11,932	6,097	10,507	910	1,064
Copra	97,464	42,716	46,626	5,662	7,531
Gambier, all kinds	2,925	1,773	1,361	271	144
Palm kernels	1,248	591	962	65	170
Palm oil	7,892	3,813	4,923	637	830
Pineapples canned	66,291	45,006	40,358	7,804	7,684
Rubber §	417,137	235,677	251,402	35,356	42,655
Sago,—flour	10,267	4,139	3,317	1,049*	1,383
,—pearl	3,128	1,401	1,220	173	171
,—raw	4,148*	2,432*	2,430*	352*	393*
Tapioca,—flake	9,028	5,276	6,669	755	661
,—flour	392	259*	128*	96*	13
,—pearl	19,977	11,902	9,511	1,455	1,536
Tuba root	165‡	63	270‡	13	39‡

† hundred in number.

§ production.

* net imports.

METEOROLOGICAL SUMMARY, MALAYA, JULY, 1933.

LOCALITY	AIR TEMPERATURE IN DEGREES FAHRENHEIT										EARTH TEMPERATURE		RAINFALL							BRIGHT SUNSHINE		
	Means of					Absolute Extremes					At 1 foot	At 4 feet	Total	Most in a day	Number of days				Total	Daily Mean	Per cent	
	A.	B.	Min.	Mean of A and B	Highest	Lowest	Max.	Min.	Lowest	Max.					Thunderstorm	Precipitation, .01 in or more	Precipitation, .04 in or more	Fog morning obs.				Gale force 8 or more
											°F	°F	°F	°F					°F	°F	°F		°F	in.	mm.	in.
	Max.	°F	°F	°F	°F	°F	°F	°F	°F	°F	°F	in.	mm.	in.	mm.	in.	mm.	hr.	hr.	%		
Railway Hill, Kuala Lumpur, Selangor	89.2	71.4	80.3	93	69	86	73	83.7	84.8	5.24	133.1	1.40	16	13	4	2	183.90	5.93	49			
Bukit Jeram, Selangor	88.0	72.4	80.2	90	70	85	75	84.1	86.6	5.03	127.8	2.00	14	10	2		193.65	6.25	51			
Sitiawan, Perak	89.7	72.6	81.1	93	70	83	76	84.6	86.1	4.56	115.8	2.85	12	10	1		176.50	5.69	46			
Kroh, Perak *	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—			
Temerloh, Pahang	88.9	72.3	80.6	92	70	84	75	84.8	86.2	3.46	87.9	1.28	14	10		1	173.50	5.60	45			
Kuala Lipis, Pahang	87.5	71.5	79.5	91	67	83	74	84.0	85.0	11.20	284.5	2.40	16	15	3	25	162.65	5.24	42			
Kuala Pahang, Pahang	86.7	73.4	80.0	90	71	83	76	85.1	85.9	6.68	169.7	2.90	11	10	1		192.15	6.20	50			
Mount Faber, Singapore	88.1	75.0	81.5	93	71	80	79	82.7	83.3	4.73	120.1	1.48	14	12			177.00	5.71	47			
Butterworth, Province Wellesley	87.3	73.9	80.6	90	72	80	77	84.6	85.8	8.77	222.8	1.80	18	14	2		187.75	6.06	49			
Bukit China, Malacca	84.7	73.6	79.1	87	71	81	80	82.6	84.3	11.59	294.4	2.64	21	17	3		166.85	5.38	44			
Kluang, Johore	86.6	71.4	79.0	90	68	82	73	81.5	82.4	4.51	114.6	1.01	20	13		10	158.05	5.10	42			
Bukit Lalang, Mersing, Johore	86.9	71.9	79.3	89	69	79	73	81.5	82.3	5.77	146.6	1.33	18	14	3	2	173.40	5.59	46			
Alor Star, Kedah	87.2	74.1	80.7	90	72	79	76	85.6	86.1	8.70	221.0	2.59	19	15	3	1	178.60	5.76	46			
Kota Bharu, Kelantan	89.2	73.4	81.3	93	70	86	76	84.5	85.2	6.35	161.3	1.89	13	9	3		197.55	6.37	51			
Kuala Trengganu, Trengganu	88.4	72.6	80.5	91	70	85	75	83.2	84.8	8.82	224.0	1.77	17	16	3	1	210.20	6.78	55			
HILL STATIONS.																						
Frazer's Hill, Pahang 4268 ft.	74.3	62.9	68.6	78	61	70	65	71.0	72.0	4.84	122.9	1.76	21	16	2	5	154.30	4.98	40			
Pahang Highlands, Tanah Rata, Pahang 4750 ft.	72.2	56.8	64.5	75	52	68	61	69.9	69.8	5.06	128.5	0.71	24	24	1		132.65	4.28	35			
Cameron Highlands, Rhododendron Hill, Pahang 5120 ft.	71.0	59.0	65.0	74	57	66	60			5.02	127.5	0.81	24	23		1	137.45	4.43	36			

Compiled from Returns supplied by the Meteorological Branch, Malaya.

*This Station has been dismantled.

THE Malayan Agricultural Journal.

OCTOBER, 1933.

EDITORIAL.

Manuring of Inland Soils.

In the *Malayan Agricultural Journal* issued in August of this year an article on the classification and properties of Malayan soils, by Mr. J. H. Dennett, was published. The article was prefaced by an Introduction by Dr. H. A. Tempany in which it was stated that it was intended to publish in this Journal a series of articles dealing with Malayan soils. Mr. Dennett's article formed the first contribution to the series now continued in a second article by Mr. W. N. C. Belgrave entitled "Preliminary Observations on Manuring of Annuals on Inland Soils", which appears in the present number.

The information contained in this article relates to inland soils and to annual crops, with regard to which there has been, up to now, less published information available than is the case with the permanent crops such as rubber, coconuts and oil palms concerning which results of manurial experiments have been published, in this and other local Journals, from time to time. Manurial experiments with the main annual crop *i.e.* rice, have also been published but the use of manures in the cultivation of rice is of necessity a specialised subject already discussed in this Journal and does not come into the scope of the present article which is concerned with annual crops grown on non-irrigated soils. Manuring in general on coastal soils, which are mainly heavy clays and organic soils, is also a subject which must be dealt with separately.

The cultivation of annual crops presents difficulties that do not arise in the cultivation of permanent crops, and it is certain that if successive annual crops, are to be obtained from an area of land, in any country, the question of manuring is of primary importance, and this applies particularly to tropical soils, newly opened up from jungle. Such soils may become rapidly infertile if nothing is done to replace the nutrient material which is removed from the soil by annual crops.

Under jungle, and to a certain extent under the conditions obtaining with permanent crops, soil is not rapidly denuded of nutrients, by reason of the fact that jungle and permanent crops such as trees and shrubs normally remove plant food from the soil at a rate which is counterbalanced to a large extent by the breaking down process, whereby the greater part of the plant food absorbed is later returned to the soil.

This process is always in operation under jungle conditions and cannot operate to the anything like the same extent in soil where a considerable proportion of the plant food is removed in the crop and is not naturally returned to the soil.

Under such conditions the use of artificial methods of replacement of nutrients is imperative and the problem in its many complex aspects, is discussed in the article now published.

It is evident that, the question of cost must be taken into consideration since it is naturally impossible to continue to employ various manures either in the form of green manures, cattle manure, or artificial fertilisers, if the cost of the operations is not justified by economic increase in the yields obtained. In this connection the advantages of using the cheapest form of manure is at once apparent, but here again the question of efficiency must be considered. Cheapness is an essential requirement in the economical employment of manures on crops from which the monetary return is not large, especially under present conditions of low prices for every agricultural commodity.

The question of the economics of manuring of annual crops is discussed in the present article and it is considered that if cheap manures prove to be ineffective, large scale cultivation of annual crops, other than wet padi, may have to be ruled out from the programme of general agricultural development on the greater part of the very old, heavily leached, inland soils of Malaya.

The third paper in this series, dealing with the question of organic matter and nitrogen in Malayan soils will be published in the *Malayan Agricultural Journal* in the near future.

Bleaching of Palm Oil.

In a previous number of this Journal* (January 1933) a comprehensive account was given of the various methods employed for bleaching palm oil.

The investigation has now been carried one stage further, one of the methods having now been developed on a semi-commercial scale.

In the article included in the present number entitled "Bleaching of Palm Oil at Serdang" Messrs C. D. V. Georgi and T. D. Marsh describe the method of air-bleaching the oil, using a catalyst.

The process is simple, no expensive plant is required, and the method gives satisfactory results. It is hoped, therefore, that those who are interested in the possibilities of bleached palm oil will avail themselves of the invitation to witness a demonstration of the process.

* *Malayan Agricultural Journal*, Vol. XXI, No. 1, January 1933.

**The Malayan
Pineapple
Industry.**

During the past few years, considerable attention has been paid to the question of the improvement of the pineapple industry in Malaya. The efforts, particularly of the Malayan Information Agency in London, to popularise Malayan tinned pineapples in Great Britain along with propaganda on the continents of Europe and America at Exhibitions and World Fairs, have been recorded from time to time in this Journal and in local newspapers. It is largely due to the success which has attended these efforts that the market for Malayan pineapples has been maintained and extended, despite competition from other producing countries.

It is not improbable, however, that the prosperity of the industry in Malaya will in the future depend largely on local efforts aiming at the improvement of the quality of the canned product. Attention is now being given to this matter not only from the commercial and manufacturing aspects, but also from the agricultural side of the question.

Reference has recently been made to the desirability of extending pineapple cultivation as a main crop. This should help to ensure a more constant supply of fruit suitable for canning. The majority of the fruit supplied to the canneries still comes from scattered areas where the crop is grown as a catch crop with rubber or is interplanted with other crops on small holdings. Recently, however, a move has been made in several centres, mainly in Johore and Selangor, to cultivate pineapples as a sole crop, and already an area of approximately 10,000 acres is under this type of cultivation.

Experimental work on pineapples has been in progress for some years, at the Agricultural Experiment Station, situated near Singapore town, where information is being collected and analysed partly with a view to estimating the manurial requirements of pineapples grown year by year as a sole crop on the same land. The land on which the experiments have been conducted is not fertile land newly opened up from jungle, but is land of poor fertility, on which pineapples had previously been grown for several years.

The results of the manurial experiments conducted on the Station, during the period June 1932 to March 1933 when the first crop was harvested, are given in the article, by Mr. G. D. P. Olds, which is published in the present number of the Journal. The results are encouraging and have provided considerable information which can be used as a guide to future experimental work, and, although it would be unwise to draw definite conclusions at this early stage of the work, it appears highly probable that methods of improving and maintaining the fertility of soil devoted to pineapple cultivation in this country, can be evolved,

Whether the methods will prove to be economic or not depends largely on the price received for the product. Prices are at present low and, mainly on account of the methods adopted in marketing whereby the industry as a whole is penalised on account of the lack of standard grades for export, there does not appear to be a likelihood of obtaining enhanced prices until the business side of the industry is better organised.

Malayan pines have a monopoly at present, of the English market, but this is being threatened by potential competition from other countries and it is very essential that the efforts now being made to effect improvements in every branch of the industry should be maintained.

Original Articles.

STUDIES IN MALAYAN SOILS.

Part II. Preliminary Observations on Manuring of Annuals on Inland Soils.

BY

W. N. C. BELGRAVE,
Chief Research Officer.

The following article deals exclusively with the commonest types of non-irrigated inland soils; inundated soils are excluded, manurial experiments with wet padi having already been described in detail in this Journal.*

Discussion of the history and composition of Malayan soils in Part I has indicated that the most generally distributed inland soil types—*viz.* quartzite, Raub and granite may be expected to be poor in nutrient material.

There is however a deeply-rooted local belief that Malayan soils are exceptionally fertile and need no manuring. Like so many popular beliefs this one rests on perfectly correct observations but on a faulty deduction. The correct observations are the luxuriance of wild vegetation (primeval or secondary jungle shrubs) and the successful growth for long periods without manuring of rubber, coconuts and wet padi. The faulty deduction is the assumption that richness of soil is an absolute instead of a relative quality. When the growth of annuals (garden or crop plants) or lawn grass is attempted under dry (non-inundated) conditions, the fallacy is exposed.

In the writer's view the explanation of the differences between the growth of annuals and trees or shrubs depends on the very different rates of absorption of nutrients shown by these plants.

The quantity of nutrients available for absorption by plants at any instant is low in any soil and particularly low in Malayan soils; processes of breakdown, however, are in continuous operation and tend to renew the available food as fast as it is absorbed. If absorption proceeds faster than breakdown the plant will starve; if the processes balance, growth, other factors being favourable, should be satisfactory. At first sight it may appear that demands by trees and shrubs greatly exceed those made by annuals, but it must be remembered that it is not total absorption but rate of absorption which must be compared with breakdown. A tree has a large volume of soil to feed on and, probably, in Malaya with its steady rainfall and temperature has the whole year in which to do it, the annual may have relatively a far smaller volume of soil and certainly has much less time available, therefore the rate per unit volume of soil of the first may be low, of the second high. A supply of nutrients sufficient for growth of the tree may then fall far short of that necessary for the annual.

* *Malayan Agricultural Journal*, Vol. 19, page 587, 1931; Vol. 20, page 631, 1932.

To prove this theory would require a prohibitive amount of work, but support may be obtained for it by comparing the rate of growth of tree seedlings with that of annuals of corresponding size such as maize or ragi. The great outbursts of activity in leaf formation, exhibited by trees or shrubs after 'wintering' or pruning, take place at the expense of reserves stored in the plant, not as the result of absorption of food from the soil at the time of flushing, and cannot therefore be quoted in support of high absorption rates.

This discussion should not be taken as implying that manures are unnecessary for crop production from trees or shrubs. Successful vegetative growth does not exclude the possibility of crop enhancement by manures.

Whether the theory outlined is true or false it is a fact that for the successful growth of annual crops, except on virgin soil, manuring is essential; if, however, the correct manures are applied, it may be predicted that satisfactory results should follow as the texture of the majority of our inland soils is excellent. Unfortunately low prices of many crop products may render manuring uneconomic in spite of considerable crop increase.

Manures.

The plant foods most likely to be deficient are nitrogen, phosphorus and potash. On special types of soil there may also be deficiency of iron, magnesium, manganese, sulphur and of other elements, but these may be neglected in a general discussion, and the supply of the three elements first named alone considered.

Manures may be divided into two broad classes, those generally manufactured or grown by the agriculturist and those purchased—artificial fertilisers. The former class comprises animal manure, composts and green manure, the latter the whole range of commercial mineral and organic fertilisers.

Natural Manures.

(a) *Cattle manure.* Where animals play an important part in agriculture, their dung is the most important source of manure; owing to the large quantity of organic debris incorporated from litter well prepared farmyard manure improves the texture of many soils and provides material for biological activity, in addition to the primary duty of adding large quantities of nitrogen, phosphorus and potash. Unfortunately animal husbandry is not an integral part of Malayan agriculture and the quality of manure made from the comparatively small number of penned animals leaves much to be desired. Urine is usually allowed to escape and the manure frequently contains a high proportion of soil.

(b) *Composts*. Comparatively recently, composts of vegetable debris in which decomposition is assisted by addition of urine, mineral salts or the patent preparation ADCO have come into prominence elsewhere as substitutes for cattle manure; work to be detailed in Part III of this series of studies does not suggest that they are likely to be more valuable than green manure in Malaya.

(c) *Green manures*. Except for such nitrogen as may be fixed from the air by bacteria in the root nodules of leguminous plants, green manures add nothing to the total plant food of the soil but should on decomposition considerably increase the available food. Both composts and green manures like cattle manure are bulky and should usefully stimulate biological activity.

Experience in other countries with all natural manures and especially with green manures is that they should either be well rotted before application (animal manure and composts) or turned in sufficiently long before planting to permit of rotting in the soil. If this is not done injury to young plants may result from reduction of available (as opposed to total) nitrogen owing to intense biological activity with resultant locking up of nitrogen in unavailable form in the bodies of bacteria and fungi.

Another possible benefit, which however is the subject of considerable dispute, is improvement of the plant by enhancement of carbon dioxide given off in the process of decomposition.

(d) *Commercial fertilisers*. Price is naturally a prime, although not the only, consideration in purchasing manures and the accepted method of comparing prices is to calculate the price of one unit of plant food, taking the unit as one-hundredth of a ton, i.e. the price of manure per ton is divided by the percentage of nutrient contained. Once standards have been established for each nutrient from manures the value of mixed manures can be calculated by multiplying unit values by the percentage of each nutrient present and summing the result.

Table A shows some properties and unit prices of the commoner fertilisers on sale in Malaya. The large margin between home and local prices of the very important manures, super and basic slag, is curious. The column headed 'reaction in soil' may refer either to direct action due to composition or to indirect action due to changes after application, the alkalinity of cyanamide or basic slag is of the former, the acidity of sulphate of ammonia of the latter class.

Full justice has not been done to some of the fertilisers in Table A, e.g. cyanamide and basis slag contain approximately 20% of lime (or of substances reacting as lime in the soil) which, at a local price of \$20 per ton for lime, adds \$4 to their value per ton and reduces the unit value of nitrogen and phosphoric acid quoted. Similarly the meals contain small quantities of phosphoric acid and potash.

TABLE A.

Manures supplying single nutrients.

	Nutrient per cent. N ‡ P ₂ O ₅ K ₂ O			Solubility in water	Reaction in Soil	Price* per unit local f.o.r.	Price† per unit in U.K.
A. Inorganic							
<i>Nitrogenous</i>							
Sulphate of Ammonia	20	—	—	Soluble	Acid	\$3.10	\$2.70 c.i.f.
Calcium cyanamide	19	—	—	Insoluble	Alkaline	3.70	3.00 c.i.f.
Nitrate of soda	15	—	—	Soluble	Alkaline	8.30	4.86 c.i.f.
Urea	40	—	—	Soluble	Neutral	5.20	—
<i>Phosphatic</i>							
Superphosphate single	—	18	—	Partly Soluble	Acid	3.00	1.50 f.o.r. (14 per cent.)
Superphosphate concd.	—	39	—	do.	do.	2.00	—
Basic slag	—	16	—	Insoluble	Alkaline	3.70	1.70 c.i.f. (14 per cent.)
Rock phosphate	—	26	—	do.	Neutral or Alkaline	1.70	0.70 c.i.f.
Local phosphate ||	6	28	—	do.	Neutral	varies	—
<i>Potassic</i>							
Muriate of Potash	—	—	50	Soluble	Neutral or Acid	2.50	1.80
Sulphate of Potash	—	—	48	do.	do.	2.30	2.20
Kainit (supplies magnesium also)	—	—	20	do.	do.	3.50	2.10
B. Organic							
<i>Nitrogenous</i>							
Blood meal	11	—	—	Insoluble	?	14.50	5.50§
Castor cake meal	4	—	—	do.	?	17.50	—
Ground cake meal	7	—	—	do.	?	11.40	—
Oil Cakes (approx.)							6.00§

* Prices to the nearest 10 cents exclusive of Railway freight in 1933.

† Prices to the nearest 10 cents in "Fertiliser" for April 26, 1933.

‡ N, P₂O₅ and K₂O designate nitrogen, phosphoric anhydride (often called phosphoric acid) and potash respectively.

|| Often called guano. In the majority of cases the quantity of nitrogen is negligible.

§ Prices given in "A Note Book of Tropical Agriculture" by R. C. Wood, 1933.

Fertilisers supplying more than one constituent.

The best known of these are the "ammonium phosphates", whale guano and bone meal. Ammonium phosphates are synthetic water-soluble bodies consisting of mixture of ammonium sulphate and ammonium phosphates in varying proportion and sold under trade names such as Ammophos (U.S.A.), Leunaphos (Germany) and Niciphos (G.B.). Taking two grades of the last named and unit values for N and P_2O_5 found from ammonium sulphate and concentrated superphosphate in Table A, calculated and actual values per ton f.o.r. are—

	per cent.	per cent.	Calculated value per ton	Local price
Niciphos A	N 14	P_2O_5 43	\$129.40	\$134.00
" B	18	18	91.80	114.50

Complete inorganic mixtures such as the Enpekey series give the following figures—

	per cent.	per cent.	per cent.	\$	\$
Enpekey No. 1	N 12.5	P_2O_5 12.5	K_2O 15	98.50	125.00
5	8	21.5	16	104.50	122.00

The best known non-proprietary organic manure supplying two nutrients is whale guano, containing 7 per cent. N and 8 per cent. P_2O_5 , selling locally at \$140 per ton; adopting the ground-nut nitrogen unit value of \$11.43 from Table A, the unit value of P_2O_5 in this manure is \$7.50. Adopting the inorganic standards used above 1 ton would be worth \$37.70.

Bone meal contains 3 per cent. N, 18 per cent. P_2O_5 ; if the organic value for N and the inorganic for P_2O_5 are used it would be worth \$70.29 per ton, the selling price is \$90 per ton; if the inorganic N value is adopted the value would be \$45.30.

The discrepancy between unit values of inorganic and organic manures is striking. Advocates of the latter claim that special benefits follow their application because organic matter is added to the soil and because the nutrients become available only as decomposition proceeds, thus providing the plant with a steady source of food. These claims do not meet with unqualified general acceptance.

Three main considerations govern the choice of a particular manure from those supplying the required nutrient at approximately equal prices. These are—retention by the soil, effect on, and availability in, the soil.

Only water soluble manures are in themselves exposed to the danger of leaching, although insoluble manures might be washed off the surface if broadcast just before a tropical storm. In point of fact nearly all soluble manures are retained by the soil either by absorption or after chemical change, the exceptions being nitrates and possibly urea. Nitrate should not be employed

in quantity on free draining soils where heavy rainfall may be experienced at any time. Insoluble manures may, as a result of change in the soil, give rise to soluble, easily leached products *e.g.* calcium cyanamide gives rise to nitrates. The latter, however, are produced gradually and the opportunity is given for absorption by crops.

Effect on the soil. As indicated in Table A certain manures have definite acid or basic characters and in certain types of soil these should be taken into account if repeated applications are contemplated. Ammonium sulphate, itself a neutral salt, in the process of nitrification (conversion to nitrates) gives rise to nitric and sulphuric acids which normally are neutralised by the bases present. When, however, bases are low (as they notably are in Malayan inland soils) there is danger of depletion by continual application leading eventually to undesirable acidity unless liming is practised.

Sodium nitrate, another neutral salt, may have undesirable effects on heavy clays for opposite reasons: the nitrate radicle is absorbed by the crop, leaving sodium hydrate or carbonate behind which deflocculates the clay, and there is therefore danger of making the land unworkable by repeated applications.

There has been considerable argument over the effect of superphosphate, but the general opinion is that it does not lead to acidification.

Availability. Most manures undergo change in normal soils, nitrogen whether as complex organic compounds in natural manures and organic fertilisers, or as ammonium salts or cyanamide, becomes transformed by bacterial action into nitrates, while soluble phosphates are more or less rapidly converted into insoluble calcium, iron or aluminium phosphates.

Potash salts undergo no chemical change but are 'fixed' as part of the soil complex.

Insoluble phosphates such as basic slag and rock phosphates are normally persistent.

Plants can absorb nutrients only in solution,* hence the practice of estimating in phosphate manures as that portion of the total P_2O_5 the 'available' P_2O_5 which is soluble in water or dilute acid and the assumption that residual P_2O_5 is only available, if at all, after the lapse of considerable periods. This theory undeniably applies to neutral or very faintly acid soils in which reversion is mainly to calcium compounds, but does not necessarily apply to highly acid soils, where the P_2O_5 of basic slag or rock phosphate may possibly be comparatively readily brought into solution, more especially if the manures are in a fine state of division, a state which should be insisted on by the purchaser. Reversion of soluble phosphates such as superphosphate or "ammonium phosphates" in such soils may be expected to be in the direction of iron phosphate which, especially at the pH of such soils, is highly insoluble. Theoretically therefore

*The vexed question of absorption of colloids is omitted from this discussion, it does not affect the argument.

the relations holding in temperate soils may be reversed in acid tropical soils and in view of the relative cheapness of rock phosphate this is clearly a matter of great economic importance and demands thorough investigation.

Unfortunately, although "availability" is a simple concept, no completely satisfactory laboratory method of analysis has yet been devised for measuring the available plant food in the soil either before or after manuring. This is not surprising when it is realised that it depends on chemical composition of the soil, texture, biological action, absorption and chemical change of added manures and the plant itself.

For a similar reason, *viz.* the complexity of the problem, chemical analysis in itself is useless as an accurate guide to manuring, all that can be done is to say that there is a possibility from the analysis that deficiencies exist. (When a mass of local information on the effect of manuring has been accumulated for a particular soil type, then analysis may be useful as means of identifying similar types elsewhere). The only satisfactory means of testing either the manural requirements of particular soils or crops or the action of particular manures is by means of plants and in the last resort, since plants differ widely in their needs, tests must be conducted with every crop. Again only actual long continued application can solve the problem of effect on the soil.

Manurial Experiments.

Most of the work now to be described was carried out in pot culture. This form of experimentation has well known disadvantages -- if exposed to weather there is heavy leaching, the soil is perforce disturbed by filling the pots, harvest is necessarily small and the larger annuals such as maize do not as a rule grow well to maturity. On the other hand pots are convenient and once the experiments are recognised as preliminary explorations, can give valuable results which can later be further tested in the field.

Experiment 1. The first experiment was carried out with ragi (*Eleusine Coracora*) and was designed to ascertain the essential elements of manuring in respect of the commonest inland soil types. From the analyses given in Part I, it appears that phosphorus is most and potash least likely to be deficient in our soils. There is definite acidity and the effect of liming requires exploration. Soils of three types were employed, *viz.* Raub high level* (locally known as laterite), granite and quartzite high level. Pots were triplicated, held 15 kilos of soil and were in the open.

The following applications were given alone or in combination ---

Cattle manure at the rate of 10 tons per acre †

Lime 2.5 do.

Green manure (*Centrosema*) 3 do.

* For a description of these types see Part I of this series.

† Calculated on a basis of a conventional figure of 1000 tons of soil per acre-foot.

Acid sodium phosphate to supply approx.	60 lbs.	P_2O_5	per acre	P
Acid potassium do.	60	" P_2O_5	"	PK
	40	" K_2O	"	
Potassium chloride do.	40	" K_2O	"	K
Urea do.	20	" N	"	N
Sodium sulphate do.	35	" Sulphur	"	S
Gypsum do.	60	" Calcium	"	Ca

TABLE B.
Result of Pot Culture Experiment with Ragi.

QUARTZITE HILL.			RAUB HILL.		GRANITE HILL.	
TREATMENT.	Average wt. of grain per living plant. Grams.	Average dry wt. of 1 plant. Grams.	Wt. of grain per plant. Grams.	Dry wt. of 1 plant. Grams.	Wt. of grain per plant. Grams.	Dry wt. of 1 plant. Grams.
Control ...	0.17	1.3	0.37	1.8	0.42	2.5
Control Lime ...	0.27	1.3	0.51	1.6	0.45	1.5
Ca. S ...	0.33	1.7	0.25	1.2	0.84	1.2
Lime, S ...	0.24	1.2	0.58	1.2	0.40	1.3
N P K ...	1.24	5.2	2.32	6.8	1.46	3.9
N P K Lime ...	0.69	2.0	0.88	2.1	0.54	1.7
N P K Lime S ...	1.35	4.1	2.00	7.0	0.90	4.3
N P K, Ca, S ...	1.43	5.3	2.35	5.7	1.11	3.82
N P ...	1.47	4.8	2.76	9.5	1.08	3.2
P K ...	0.59	2.6	2.40	5.6	0.66	2.2
N K ...	0.20	1.4	0.89	2.3	0.39	1.9
P ...	1.00	2.9	1.65	5.5	1.0	3.2
N ...	0.69	3.2	0.5	2.1	0.47	1.9
Cow dung ...	1.40	5.5	3.95	10.9	1.82	5.6
Cow dung + Lime	2.18	5.9	6.75	12.3	4.10	9.5
Green Manure ...	0.28	2.7	0.84	2.5	0.41	1.8
Green Manure + Lime	0.46	2.0	1.26	4.4	0.54	1.7
Green Manure + $\frac{1}{4}$ NPK	1.17	4.3	1.87	4.7	2.00	3.8
Green Manure + Lime	1.41	5.5	1.41	4.4	1.42	5.1

Ca = Calcium as sulphate.

S = Sulphur as Sodium sulphate.

Sodium and potassium phosphate were employed to avoid the possible effect of calcium in super or basic slag and urea to avoid sulphur in ammonium sulphate and calcium in cyanamide. Gypsum was employed to test the effect of calcium as a food as distinct from the neutralising action of lime.

Pots were filled and allowed to settle for two months.

Lime was applied 9 weeks, green manure and cow dung 8 weeks, artificials except urea 4 weeks, urea 2 weeks before transplanting of seedlings which had been germinated in garden soil until 3" high. There was considerable mortality and unevenness of growth in the poorer pots. Results (weight of plants and grain) are given in Table B and show clearly the poor yield of the control, the fact that calcium, sulphur and potash appear to be unnecessary, that phosphorus is the key element and that nitrogen is necessary. Lime in the large dressing given reduced the increase due to artificials, but increased that due to cattle manure. Green manure alone or with lime gave poor results, but with a small dressing of artificials gave good results.

The discordant results of lime on artificials and on cattle manure may possibly have been due to reduction of solubility of phosphate in the first case and acceleration of decomposition in the second. The acidity of the soils was clearly not injurious to ragi. It was apparent that no real differences of response existed between the three soils employed.

The clear indication from this experiment of the importance of phosphorus led to considerable laboratory work on the subject with the especial object of tracing the fate of phosphatic fertilisers added to the soil. This work was fruitless and it need only be said here that all methods agreed in showing very low concentrations of total and "available" phosphorus in our soils and exceedingly high and rapid fixation of added soluble phosphates.

This high adsorption (or reversion) appeared to strengthen the case for the theoretical possibility put forward above that additions of small quantities of soluble phosphate might not influence plant growth, being entirely adsorbed by the soil, and that the addition of considerable quantities might be necessary for response. Experiment I did not support this view, but the quantity of P_2O_5 applied was not small and it was clearly necessary to test other plants which might possess less efficient means of adsorption.

Experiment II. Another series of pot experiments was started in which gingelly (*Sesamum indicum*) was used, this plant having been found to be highly sensitive to deficiency of P_2O_5 . It was decided to limit observation to the first six weeks of growth as the absorption should be high during this period and differences of availability should exercise their maximum effect. Small pots holding 1 kilo of soil were used and quantitative observations on growth were made. Manures were applied approximately 2 to 3 weeks before planting.

Treatments were — cattle manure, superphosphate, basic slag, ferric (iron) phosphate, aluminium phosphate and Sterameal—a proprietary complete organic mixture on the local market — all adjusted to supply P_2O_5 at the rate of 30, 60, 120 and 240 lbs per acre.

Three soils were employed — Raub high level and quartzite high level as in Experiment I and an infertile dark quartzite valley soil from the Government Experimental Plantation, Serdang, and treatments were triplicated. The pots were kept in a plant house and watered daily, leaching being avoided.

The lower applications of cattle manure were at the rate of 2.5 and 5 tons per acre. These quantities are far below normal field applications but were applied to test possible specific effects of this manure apart from the effect of massive applications of N, P and K in the larger dressings. Pots treated with super, basic slag, iron and ammonium phosphates and controls received a dressing of ammonium nitrate supplying N at the rate of 25 lbs. per acre. It was realised that increasing quantities of nitrogen and potash were supplied by cattle manure and Sterameal but this had to be accepted.

Results of the four weeks showed very poor growth of controls and very little benefit from iron or aluminium phosphates on all soils. Cattle manure was little if at all better than equivalent dressings of basic slag on the quartzite and Raub high level but definitely better at all concentrations on the quartzite valley soil. Basic slag was much better than super on the quartzite hill and better at high concentrations on Raub. Sterameal was about equal to basic slag on all soils. After six weeks the results were approximately as shown in Table C.

TABLE C.

Quartzite Hill.

MANURE.		LBS. P_2O_5 PER ACRE.			
		30	60	120	240
Cattle	...	Good	Medium	Good	Medium
Superphosphate	...	Poor	Poor	Poor	Poor
Basic slag	...	Good	Good	Good	Very Good
Aluminium phosphate	...	Very Poor	Very Poor	Very Poor	Very Poor
Ferric phosphate	...	"	"	"	"
Sterameal	...	Poor	Medium	Very Good	Very Good
Control	...	Very Poor			

Quartzite Valley.

MANURE.		LBS. P_2O_5 PER ACRE.			
		30	60	120	240
Cattle	...	Good	Very Good	Very Good	Good
Superphosphate	...	Medium	Medium	Medium	"
Basic slag	...	Poor	"	"	Medium
Aluminium phosphate	...	Dead	Dead	Dead	Dead
Ferric phosphate	...	"	"	"	"
Sterameal	...	Medium	Poor	Medium	Poor
Control	...	Dead			

Raub High Level.

Cattle	...	Dead	Poor	Poor	Medium
Superphosphate	...	Poor	Medium	"	Good
Basic slag	...	"	"	Medium	"
Aluminium phosphate	...	Very Poor	Very Poor	Very Poor	Very Poor
Ferric phosphate	...	"	"	"	"
Sterameal	...	Medium	Poor	Good	Very Good
Control	...	Very Poor			

Facts which stand out are the specific effect of cattle manure on the quartzite valley soil, the superiority of basic slag over superphosphate on quartzite hill soil, the large dressings needed on the Raub soil to produce marked effect, the poor effect of cattle manure on the Raub soil, the absence of special advantages from the organic mixture in economic applications, and the uselessness of iron and aluminium phosphates. Superphosphate even in the smallest dressing gave some response on all soils and where small dressings gave poor results large dressings did not improve matters; it does not appear therefore that absorption or fixation entirely removes it from the sphere of even very young plant roots.

The absence of very large differences between the action of superphosphate and basic slag on Raub and quartzite valley soils also casts doubt on the theory that soluble phosphates are fixed beyond the reach of plants, and suggests that some other explanation must be found for differences between the action of the two manures where such exist. The negative results with iron and

aluminium phosphates at first sight appear either to contradict the deduction in the preceding paragraph or the previous suggestion that in our soils fixation occurs by iron, but it must be remembered that, although finely powdered, the phosphates added were in an infinitely coarser state of division that would be iron-fixed phosphate formed in the soil.

During the course of the experiment it became clear that the pots were too small to be entirely satisfactory. There was rapid drying out of the surface owing to the high temperature of the plant house and even with daily watering the plants may have suffered from violent fluctuation of water content of the soil. The next step was therefore to lay out small scale field tests.

Experiment III. Soils used were as in Experiment II, planting was carried out on slightly raised beds, 4' x 4', in the field, and nitrogen was studied as well as phosphorus. Beds on the quartzite valley and Raub soils were situated at the Government Experimental Plantation, Serdang,* on the quartzite hill at the Experimental Plantation, Kuala Lumpur. The latter soil was particularly sandy and had been heavily eroded for many years. Crops used were maize, dry padi and sweet potatoes. The second, as usual with small isolated areas of padi, was heavily attacked by borers and the potatoes by pig and insects. Neither came to maturity but as far as could be judged by vegetative growth over a period of 6—8 weeks would have given results in general agreement with those for maize detailed below in Table D.

Treatments were in duplicate for each crop and were designed in the case of artificial to supply 35 lbs. N, 50 P_2O_5 , 50 K_2O and 50 lbs. magnesium oxide per acre, and to test acid against basic manures. Owing to a prolonged dry spell in the second half of the experiment setting of ear was poor and ripening very uneven, in consequence reliance cannot be placed on harvested weights. There was however remarkable agreement between duplicates for vegetative growth, which generally was best on the Raub and worst on the quartzite valley soil.

Dates of treatments were as follows—Lime applied 2nd and 3rd February 1932; green and cattle manure 15th—16th February; super, basic and rock phosphates 1st—2nd March; sulphates of potash, ammonia and magnesium and "ammonium phosphate" 3rd—4th March; all other fertilisers 7th—8th March. Planting 22nd—25th March. The differences detailed in Table D manifested themselves early and continued all through. Reasons for the various mixtures are obvious and need not be detailed.

Observations which confirm those of Experiment I are—

- (a) The soil quite definitely needs treatment.
- (b) Phosphorus is the key element, but nitrogen is also necessary.
- (c) Neither nitrogen alone nor nitrogen and potash mixed without phosphorus are useful.
- (d) Cattle manure is excellent.
- (e) Lime is not necessary and does not even improve green matter.

* Plots at the Government Experimental Plantation, Serdang, were in charge of Messrs. T. D. Marsh and J. L. Greig.

TABLE D.
Appearance of Maize at end of May.

		Quartzite Hill	Quartzite Valley	Raub Hill
1.	Superphosphate	Poor	Very poor	Medium
2.	Basic slag	Good	Medium	Medium
3.	Rock phosphate	Medium	Poor	Very poor) Medium)
4.	Control	Poor	Very poor) Poor)	Dead) Poor)
5.	Basic slag and lime (1 ton)	Medium	Very good) Good)	Good) Medium)
6.	Basic slag + Pot. sulphate	Medium	Very good	Very good
7.	do. do. + cyanamide	<i>Very good</i>	<i>Very good</i>	<i>Very good</i>
8.	do. do. do. + lime	Very good	Very good) Good)	Very good)
9.	Basic slag and cyanamide	Medium	Very good) Medium)	Very good) Good)
10.	Ammonium phosphate	Very poor	Very poor) Dead)	Dead) Medium)
11.	Ammonium sulphate + super	Poor	Medium) Very poor)	Medium) Poor)
12.	Basic slag, cyanamide and lime	Medium) Poor)	Medium)	Good) Very good)
13.	Rock phosphate and cyanamide	Poor)	Medium) Poor)	Poor) Very good)
14.	Basic slag and castor cake	Good) Poor)	Very good) Good)	Good) Very good)
15.	Control	Poor	Very poor	Dead) Very poor)
16.	Cyanamide and Pot. sulphate	Poor	Medium) Good)	Poor)
17.	Cyanamide	Poor	Very poor) Medium)	Very poor)
18.	Amm. sulphate	Dead) Poor)	Dead)	Poor) Dead)
19.	Castor cake	Poor) Medium)	Poor) Very poor)	Medium)
20.	Cattle manure (2½ tons) and basic slag	Very good) Good)	Very good)	Very good) Good)
21.	Cattle manure (10 tons)	<i>Very good</i>	<i>Very good</i>	<i>Very good</i>
22.	Cattle manure and lime	<i>Very good</i>	<i>Very good</i>	<i>Very good</i>
23.	Steramical 500 lbs.	Good	Very good	Very good
24.	Steramical 240 lbs.	Poor) Medium)	Very poor) Medium)	Medium)
25.	Green manure 3 tons	Poor	Very poor	Medium) Poor)
26.	Green manure and basic slag	Poor) Medium)	Medium)	Good)
27.	Green manure and lime	Poor	Medium	Medium) Poor)
28.	Control	Very poor) Poor)	Dead)	Medium) Dead)
29.	Basic slag, cyanamide, Magnesium sulphate	Very good	Good	Very good) Medium)
30.	Lime	Poor	Medium	Medium) Poor)

Where only one description is given, duplicates agreed perfectly.
Italics indicate outstanding merit.

Observations which go further are —

- (a) Of P alone, on both quartzites, superphosphate alone is poor, basic slag best and rock phosphate intermediate; on Raub basic slag and super are equal.
- (b) Of N alone, ammonium sulphate appears to be injurious.
- (c) Of NP mixtures, "basic" cyanamide-basic slag is definitely superior to "acid" ammonium sulphate-super on all soils, while most unexpectedly "ammonium phosphate" is toxic.
- (d) Potash is necessary for best growth and even without nitrogen enhances the effect of phosphorus.
- (e) Green matter appears to be useless.
- (f) The complete organic manure in normal application was not effective.
- (g) Castor cake mixed with basic slag gave good but not excellent growth and in this case excess expenditure for N in organic form would not have been recovered. It is of course legitimate for the advocates of organic fertilisers to argue that the experimental period was too short to permit thorough decomposition of either Sterameal or castor cake.
- (h) Magnesium is not essential.

The excellent effect of cattle manure on all soils in this experiment is in opposition to the results in Experiment II; as stated above the latter experiment cannot be considered to be satisfactory. The superiority of basic slag over superphosphate on quartzite hill may be taken as proved and the very marked superiority of the basic NP mixture suggests that the explanation may be found in the difference of reaction between the two fertilisers rather than reversion to unavailable iron phosphate.

Both for cyanamide and basic slag there is also the possibility that the application of a relatively small quantity exactly where it is wanted,* *viz.* in intimate contact with the manure particles, may do good even though mass applications of large quantities do not improve the effect of acid manures. The lime in the latter case cannot be mixed with the manure (or loss of ammonia as gas and reversion of phosphate would occur) and in a limited period there is no guarantee that a majority of manure particles or of soil particles which have adsorbed manure ever encounter particles of lime. Previous experiments† had shown that nitrification of both ammonium sulphate and cyanamide proceeded normally.

It was decided to carry out further investigations on combinations of NP manures.

Experiment IV. The large pots of Experiment I and quartzite hill soil were employed. Pots were in the open and were replicated. Applications were made as follows — lime three weeks, basic slag, super phosphate and rock

* *c.f.* the views of Crowther. J. Ag. Sc. 22, p. 329, '32.

† Belgrave, W. N. C.; this Journal 17, p. 192, '29.

phosphate two weeks, ammonium sulphate, cyanamide, urea and "ammonium phosphate" one week before sowing of gingelly. Quantities used supplied P_2O_5 at the rate of 50 lbs. and N 35 lbs. per acre, lime was applied at the rate of 2 cwt. per acre, sufficient to neutralise acidity from nitrification of ammonium sulphate (if contact was effected.)

Germination was excellent except on "ammonium phosphate" and the plants were thinned out to 3 per pot after a week.

Table E describes the plants after 17 days and after 2 months' growth.

Agreement between replicates was very good. After this period, when the better plants were in flower all plants lost ground and exhibited signs of ill-health. This point will be discussed later.

TABLE E.

Growth of Gingelly.

TREATMENT		After 17 days	After 2 months
Lime and am. sulph. and super	...	Fair	Fair
Am. sulph. and super	...	Poor	Dead
Am. sulph. and basic slag	...	Poor	Dying
Cyanamide and super	...	Good	Good
Cyanamide and basic slag	...	Very good	Very good
Am. phosphate	...	Very poor. dying	Dead
Am. phosphate and lime	...	Fair	Poor
Urea and super	...	Fair	Dying
Urea and basic slag	...	Very good	Very good
Cyanamide and rock phosphate	...	Very good	Very good
Am. sulph. and rock phosphate	...	Poor	Dead
Control	...	Very poor	Dead

It is obvious that the preponderant influence of 'acid' and 'basic' is exercised by the nitrogenous manures and that cyanamide is definitely valuable. Rock phosphate is here valuable and has been found to be so in a number of subsequent experiments, poor results given by it in Experiment III await explanation.

The toxic influence of "ammonium phosphate" is definite and is not eliminated by lime. In order to test residual effect of all manures and particularly possible residual toxic effect of ammonium phosphate, after removal of gingelly, maize was sown without further treatment. Growth at the end of 1 month was as in Table F.

TABLE F.
Growth of Maize.

PREVIOUS TREATMENT	Result
Lime and am. sulph. and super ...	Very good
Am. sulph. and super ...	Poor
Am. sulph. and basic slag ...	Good
Cyanamide and super ...	Fair
Cyanamide and basic slag ...	Very good
Am. phosphate ...	Very poor
Am. phosphate and lime ...	Medium
Urea and super ...	Medium
Urea and basic slag ...	Medium
Cyanamide and rock phosphate ...	Very good
Am. sulph. and rock phosphate ...	Medium
Control ...	Medium

After this period all plants rapidly went off.

Clearly cyanamide is still exerting its good influence, added lime appears now to have overcome the bad effect of the acid am : sulph : super mixture and the bad effect of ammonium phosphate persists thus answering a possible criticism that it had previously been applied too soon before sowing.

The ammonium phosphate used in Experiments III and IV was a mixture of two grades of German origin and there seemed a remote possibility that material made by other manufacturers might behave differently.

Experiment V. Large pots with quartzite soil were treated with (a) British, (b) German ammonium phosphate mixtures, (c) cyanamide and basic slag all to supply quantities of N and P_2O_5 as in Experiment IV, and (d) control. Each treatment was replicated six times, three pots being sown with

gingelly and three with maize. Results exactly confirmed those of previous experiments; there was no difference between the results from German and British material and both were definitely toxic.

Experiments IV and V were NP mixtures, but Experiment III had indicated potash as desirable for best growth, at any rate when a basic mixture was employed. It was now necessary to test the effect of potash in acid mixture and in ammonium phosphates.

Experiment VI. Large pots, maize and gingelly were used. Applications of "acid" (am. sulph. super) "basic" (cyanamide and basic slag) and ammonium phosphates were made as in Experiments IV and V to half the pots, sulphate of potash to supply K_2O at the rate of 35 lbs. per acre was added. There were 4 replicates of each treatment which showed good agreement. Unfortunately very heavy rains were experienced about 3 weeks after sowing which caused falling off of growth earlier than usual.

Results were—potash reduced the extreme toxicity of ammonium phosphate and improved all mixtures but did not alter their order of merit.

Two pots each of maize and gingelly were tested with ammonium phosphate to which calcium sulphate had been added, growth was very bad and worse than those to which potash had been added.

Experiment VII.* About this time experiments to be described in Part III of the series indicated that the poor results from green manure in Experiments I and III might have been due to the fact that it was turned in too long before planting of seed and that further exploration was desirable. Accordingly large pots were filled with quartzite hill soil, acid and ammonium phosphate mixtures of the previous experiments (without potash) and cyanamide and rock phosphate were applied one week before planting and cuttings of carpet grass (*Axonopus compressus*) turned in at the rate of 20 tons per acre on the day of sowing maize and gingelly. There were three replications of each treatment.

The pots without grass gave the usual results i.e. ammonium phosphate killed gingelly early and seriously damaged maize, the acid mixture gave poor medium growth and the cyanamide rock phosphate mixture excellent growth for about two months with both maize and gingelly.

The grassed pots showed marked differences, gingelly was completely killed as usual by ammonium phosphate and received a severe check from grassing on the other two mixtures lasting 4—5 weeks. Maize benefited from grassing in all cases from the start.

Gingelly in the acid and basic pots threw off the check and rapidly overhauled the ungrassed pots and with maize made excellent growth up to the time of fruiting. Seed was set well from gingelly but the maize cobs did not fill. There were still slight differences in favour of cyanamide and rock phosphate and ammonium phosphate was definitely poorest with maize.

* This experiment was performed by Mr. R. G. H. Wilshaw,

Summary of results and conclusion from Experiments I - VII.

The experiments have proved that phosphorus and nitrogen are essential for good growth of all annuals tried. Potash was not essential for ragi but definitely improves maize and gingelly when added to NP mixtures in the absence of green matter. Basic slag is better than superphosphate on quartzite soil but it cannot be proved that this is due to reversion of the latter to an unavailable form.

Cyanamide is definitely better than ammonium sulphate in NP mixtures especially in the absence of fresh green matter.

Heavy liming is unnecessary and may with artificials do harm, but a small quantity of lime, if contact could be effected, would probably improve ammonium sulphate. The excellent effect of cyanamide and basic slag may well be due to intimately mixed lime or lime producing materials.

There appears to be no shortage of calcium (as a nutrient), magnesium or sulphur.

Continued growth of maize and gingelly was impossible in pots without the incorporation, immediately before planting, of green matter.

Green matter turned in six weeks before planting had little effect even if mixed with phosphate and will be shown in Part III to have a transient effect if turned in alone early.

Rock phosphate gave excellent effect in pots but surprisingly failed in small scale experiments in the field.

Ammonium phosphate with or without green matter, lime or potash appeared to be detrimental to annuals on the soils explored. Cause of injury is very obscure but does not appear to be related to calcium starvation since addition of calcium sulphate did not help.

Little or no change of acidity has been found in any of these experiments and the reactions which undoubtedly take place must be limited to the immediate neighbourhood of added fertilisers.

Cattle manure gave excellent results except in Experiment II.

A series of exploratory experiments has been conducted recently by Field Officers with maize on duplicated beds 6' x 6' using complete (NPK) acid basic and ammonium phosphate mixtures, cattle and green manure (without artificials).

Results from green matter were uniformly poor, confirming observations described above. Only in two cases did the basic mixture show superiority and only in one case was ammonium phosphate lethal. Addition of potash may have helped to level up the mixtures. Cattle manure was nowhere outstanding and nowhere was growth really satisfactory.

Striking confirmation of the superiority of basic over acid mixtures has been obtained in a replicated manurial experiment on guinea grass conducted at the Government Experimental Plantation, Serdang, in connection with fodder investigations. Results will be published later by Mr. V. R. Greenstreet,

On the practical side a replicated experiment with plots of 1/40 acre is being laid out at the Government Experimental Plantation, Serdang, to test growth of various annuals with turning in of green matter, leguminous and non-leguminous, in conjunction with various manures. A smaller version of this experiment is also to be laid down on several Agricultural Stations scattered about the country. Once the best treatment for green manure and the minimum requirement for nutrients have been determined on a field scale it should be comparatively simple although time-consuming to determine the correct kind of manure to supply that nutrient.

Until this work is completed it would appear safer to rely for the present on basic NP mixtures together with green matter turned in early for the growth of annuals on previously cultivated soils.

Calcium cyanamide has fallen into disfavour in the United Kingdom, three charges being made against it, (a) formation of a toxic compound in soils, (b) deterioration in opened packages and (c) injury to the skin of labourers; it is also slightly more expensive than ammonium sulphate. Modern preparations should not exhibit toxicity and no trace of it has yet been encountered in these and other local experiments, even where it was applied as a part of a mixture as top-dressing to backward maize; all the cyanamide used in these experiments has been kept in paper lined gunny bags without any more serious consequences than the formation of a thin crust on the exterior; skin injury can be avoided by a preliminary coating of vaseline on hands and arms. This manure is not manufactured in the British Empire.

Experiments are being laid down to test the possibility of enhancing the effect of ammonium sulphate by preliminary mixing with chalk or very finely powdered limestone (lime cannot be used) but until these results are known it would appear desirable to rely on cyanamide as source of nitrogen.

In view of the comparative failure of rock phosphate in Experiment III it would appear better for the present to rely on basic slag; further experiments are necessary before it can be said with certainty that this manure can be effectively replaced for this class of cultivation by the cheaper rock phosphate.

Local supplies of phosphates occur in Perak, Kedah, Perlis and Kelantan with in general P_2O_5 content ranging from 20—25 per cent. and in some case a satisfactory standard of solubility in dilute acids. Export to other States is however restricted and methods of exploitation somewhat haphazard. Cases have occurred of samples with a P_2O_5 content as low as 6 per cent. finding their way to the market and although good samples should be as efficient as imported rock phosphate care should be taken to purchase only material of guaranteed composition and fineness of division.

Ammonium phosphates should clearly be avoided. From Experiment VII potash would not appear to be necessary provided the essential addition of green matter is carried out.

It is clear that this discussion has left many points of the highest interest in the behaviour of our soils unsolved. The most interesting is the behaviour of green matter—why must it be turned in late? Is the formation of “humus” in our soils, a myth and does benefit accrue only when the first vigorous decomposition of sugars and proteins is in progress. If so, why should the benefit conferred outlast this period of rapid decomposition? Does decomposition in the soil give rise to iron humate without which iron may be unavailable? Or does it result in increase of available nutrients by accelerating mineral breakdown? A further discussion of some of these possibilities will be found in Part III of this series.

In any case it appears that green manure may obviate the use of potassic manures for certain crops and it is hoped that it may be found that nitrogen also is capable of reduction or elimination. Cheapness is essential for economic employment of manures on low-value tropical food crops. If cheap manures prove to be ineffective large scale cultivation of annual crops other than wet padi may have to be ruled out from the programme of general agricultural development on the greater part of the very old, heavily leached inland soils of Malaya.

Other Crops and Soils.

It is to be clearly understood that both observations and recommendations above refer to annual crops on the general run of inland soils, conditions may be and undoubtedly are totally different for larger and more permanent forms of cultivation, and possibly for annual crops on alluvial coastal soils, on pockets of rich river alluvium in inland districts and on the volcanic soils of Pahang. Manuring on the less impoverished and frequently very heavy coastal clays and on peaty and organic soils presents special problems and demands special study. In the Departmental manurial experiments on Oil Palm phosphorus alone appears to be necessary for enhanced crop production where unmanured yields are low, but ammonium sulphate in an acid NP mixture has not reduced yield on quartzite hill soils; this is not surprising as the root system may be stronger than that of an annual and, as explained in the introduction, absorption is probably slower thus giving more time for adjustment of internal equilibrium to the plant. It is understood that ammonium phosphate has given good results in estate manuring of oil palms.

In view, however, of the weak buffering (*vide* Part I) of our inland soils it would appear inadvisable to risk souring or undue extraction of bases by long continued application of acid manures or mixtures. Alternation of acid and basic or two applications of acid to one of basic would probably maintain a balance.

Coconuts growing on heavy soils have not so far shown response to manuring.

In addition to experiments on coconuts and oil palms* experiments are in progress at one or other of the Departmental Stations on manuring of tea, coffee, pineapple, arecanuts, pepper and tapioca. In most of these, acid and basic mixtures are undergoing comparison so that in a comparatively short time, measured in years, there should be that body of information on manuring in Malaya which has long existed in those countries which have in the past relied on agricultural rather than forest products.

Summary.

General considerations on manures and manuring are discussed.

An account is given of experiments on small scale manuring of annual crops on inland soils from which phosphorus and nitrogen are seen to be necessary and best applied in basic form.

Future work is outlined and recommendations made for immediate use.

All pot experiments were carried out by Haji Abdul Wahid bin Haji Jaffar, Acting Malay Research Officer. The writer desires to acknowledge his care and accuracy of observation.

* Described in this Journal Vol. XX, p. 105, 304; 1932.

EXPERIMENTAL WORK IN RELATION TO PINEAPPLES.

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With an Appendix,

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Introductory.

An Experiment Station, which is under the charge of the Agricultural Field Officer, Singapore, and is situated at Lim Chu Kang some seventeen miles from Singapore town, was opened up in the year 1930 primarily to provide facilities for conducting field experiments with pineapples. At the same time it was recognised that such a Station should also provide facilities for small scale experiments with certain other crops and for the distribution of planting material of fruit trees. Owing, further, to the necessity for investigating crops which could be grown in rotation with pineapples, experiments on other crops notably tobacco have also been included in the programme of work.

Visitors to the Station have been numerous for some time and the work has aroused considerable interest in many sections of both planting and business communities.

The following report on the experiments conducted with pineapples gives an outline of the progress made from June 1932 to the end of the first crop of pineapples, the approximate date for which was March 1933.

Experiments.

In June 1932, the position with regard to pineapple experiments was as follows :—

Three main experiments had been laid down as follows :—

- (i) A randomised block manurial experiment, containing seventy-two one-twentieth acre plots, there being 12 treatments each repeated six times.
- (ii) A cultural treatment experiment, containing 10 plots of 1 sq. chain each, 5 different cultural treatments being represented in the experiment.
- (iii) A combined planting distance and manurial experiment, consisting of 24 plots of 1 sq. chain each, with 4 different planting distances.

Since the primary objects of the experiments are to discover the most suitable dressing of manures, the most suitable planting distance and the best cultural methods, on land which had previously been occupied by pineapples, and which is typical of considerable areas of Singapore and Johore land, the results of the above experiments, taken to the end of the first crop, are of considerable interest.

Manurial Experiment.

The 12 manurial dressings applied were as follows :—

(1)	Lime only	—	$\frac{1}{2}$ ton per acre.
(2)	Lime	—	$\frac{1}{2}$ ton per acre.
	Sulphate of Ammonia	—	100 lbs. per acre.
	Superphosphate	—	300 lbs. per acre.
	Sulphate of Potash	—	100 lbs. per acre.
(3)	Lime	—	$\frac{1}{2}$ ton per acre.
	Sulphate of Ammonia	—	100 lbs. per acre.
	Superphosphate	—	300 lbs. per acre.
	Sulphate of Potash	—	100 lbs. per acre.
	Magnesium Sulphate	—	240 lbs. per acre.
(4)	Control	—	no manure.
(5)	Sulphate of Ammonia	—	100 lbs. per acre.
	Superphosphate	—	300 lbs. per acre.
	Sulphate of Potash	—	100 lbs. per acre.
(6)	Sulphate of Ammonia	—	100 lbs. per acre.
	Superphosphate	—	300 lbs. per acre.
	Sulphate of Potash	—	200 lbs. per acre.
(7)	Sulphate of Ammonia	—	100 lbs. per acre.
	Superphosphate	—	300 lbs. per acre.
	Sulphate of Potash	—	100 lbs. per acre.
	Magnesium Sulphate	—	240 lbs. per acre.
(8)	Superphosphate	—	300 lbs. per acre.
	Sulphate of Potash	—	100 lbs. per acre.
(9)	Sulphate of Ammonia	—	100 lbs. per acre.
	Superphosphate	—	300 lbs. per acre.
(10)	Sulphate of Ammonia	—	100 lbs. per acre.
	Sulphate of Potash	—	100 lbs. per acre.
(11)	Rotted Pineapple Refuse	—	10 tons. per acre.
(12)	Cattle Manure	—	10 tons per acre.

From June 1932, the best growth was exhibited by all plots which were treated with a complete dressing of artificials as in treatments (2), (3), (5), (6) and (7), although a definite response to phosphates was also apparent. The "lime only" plots, and control plots were much less vigorous than the plots

dressed with fertilisers, the difference being particularly marked during spells of dry weather. The appearance of all plots varied with the amount of rainfall and the general impression that the experiments gave was that the unmanured plots were suffering from a definite lack of plant food, whereas the fertilised plots were able to withstand longer periods of drought with less signs of starvation.

Fruiting commenced on a few plots in August 1932, the first plots to produce fruit being those which had been treated with phosphates; at this time also the differences between treatments became more marked.

For the first month, after fruiting commenced, records of the number of fruits per plot only were kept, but subsequently the weights of the fruit per plot were recorded.

The figures given below form a summary of the yields in numbers of fruit per acre and mean weight of one fruit in each plot, taken as an average of six plots, and for the first crop only.

Yields from Manurial Experiment.

Treatment No.	Number of fruits per acre.	Mean weight of one fruit in lbs.
1	153.2	4.08
2	766.0	3.84
3	723.2	4.13
4 (control)	156.0	3.66
5	910.0	3.81
6	1466.6	3.86
7	1063.2	3.61
8	566.6	3.84
9	733.2	3.70
10	270.0	3.60
11	263.2	3.84
12	700.0	3.69

The response to manuring on the first crop has been remarkable. The control plots yielded an average of 156 fruits per acre only as compared with the average of 1466.6 fruits per acre given by the six plots of treatment No. (6) (Sulphate of Ammonia, 100 lbs., Superphosphate 300 lbs., and Sulphate of Potash 200 lbs.) It should be noted also that there is a decided response to the *double* dressing of Potash, since treatment (5) is the same treatment as treatment (6) with the exception that it includes half the amount of Potash, and the figures show a difference of 556 fruits per acre between the two results.

Treatment No. (7) actually gives the next highest yield to treatment No. (6) and this again contains a complete dressing of Nitrogen, Phosphate and Potash (100 lbs.) with the addition of Magnesium Sulphate, but the increase over treatment (5) is relatively small. Since comparison of two other treatments, viz. (2) and (3) also gives the effect of the addition of Magnesium Sulphate and since that ingredient has shown no increase in this instance (there is in fact a decrease), it seems probable that the addition of Magnesium Sulphate to the complete dressing produces no marked increase in yield and is therefore unnecessary.

The remaining treatments call for no special comment, except to indicate the necessity of including Nitrogen, Phosphate and Potash in any mixture of artificial fertilisers. The cattle manure and pineapple refuse treatments both show an increase over the control but the increase is comparatively small.

Since the results of the first crop only are so far available, and prices for pineapples have suffered from continual fluctuation for several months past, it would be unwise at this stage to attempt costings. The experiments have not yet proceeded far enough to indicate the residual value of the fertilisers and for that reason any estimate of cost at this stage would probably be inaccurate.

The conclusions that may be drawn from the manurial experiment to-date may be summarised as follows:—

(i) On old pineapple land of a sandy quartzite nature, some form of reconditioning of the soil is essential if pineapples are to be grown successfully.

(ii) The dressing which has given the highest increase in yield to-date is treatment No. 6 which consists of 100 lbs. of Sulphate of Ammonia, 300 lbs. of Superphosphate and 200 lbs. of Sulphate of Potash. Significantly beneficial results have also been derived from treatments Nos. 2, 3, 5, 7, 9 and 12.

(iii) There is a definite response to Phosphates; the position with regard to Potash is on results so far obtained somewhat contradictory.

(iv) Liming alone, produces no beneficial effect on the number of fruits yielded, although it may increase the weight of each fruit. Liming in combination with other manures appears to have a depressing effect.

(v) Cattle manure at the rate of 10 tons per acre produced a definite increase in yield but the increase does not justify the cost of this fertiliser except where easily and cheaply obtained.

(vi) Fertilisers containing Phosphates give early maturity.

(vii) The following manures failed to benefit the crop significantly:—

(a) Lime,

(b) Sulphate of Ammonia and Potash,

(c) Pineapple refuse.

Green Manurial Experiment.

In addition to the main manurial experiment outlined above a green manurial experiment was laid down in the season 1932—1933.

This is an experiment designed to indicate the respective effect on the growth and yield of pineapples of the following green manures which were chankolled in prior to planting with pineapples.

- (i) *Crotalaria anagyroides*,
- (ii) *Tephrosia candida*,
- (iii) *Mimosa invisa*,
- (iv) Ground nuts,
- (v) Natural grass, free from "lallang",
- (vi) Natural grass, lallang, and weeds.

The above green manures had all been established by June 1932, but no pineapples had been planted. This experiment has since that time been divided into two blocks on one of which pineapples have been planted after one crop of green manure, and on the other after two crops of green manure. The whole of this experiment is now under pineapples and excellent growth has been made to date. Little difference between treatments is discernible as yet but there are signs that the greatest effect is taking place in the "natural grass" and "Mimosa" plots. Each treatment is repeated twice in each block.

All plots in this experiment have so far been unmanured, except for the fertilisers previously applied to the green manure crops. These consisted of Sulphate of Ammonia $\frac{1}{2}$ cwt., Basic Slag 3 cwt. and Sulphate of Potash $\frac{1}{2}$ cwt. per acre.

The planting distance adopted for this experiment is 5' x 2' x 2' double row planting.

Cultural Treatment Experiment.

The cultural treatment experiment laid down consists of 5 treatments each repeated twice, on plots of 1 sq. chain planted with pineapples at 5 ft. x 2½ ft.

The treatments were :—

- (1) Mulched with PABCO Thermogen paper.
- (2) Forked once annually.
- (3) Clean weeded.
- (4) Mulched with pineapple refuse.
- (5) Unweeded.

All plots in this experiment, owing to their backward growth were fertilised in their early stages with a complete dressing of artificials at the rate of 250 lbs. per acre as follows :—

Sulphate of Ammonia	...	100 lbs.
Basic Slag	...	300 "
Sulphate of Potash	...	100 "

The results obtained for the first crop from this experiment show very marked differences between treatments, the most outstanding result being that yielded by the PABCO paper mulch plots. Here a very considerable increase both in number and weight of fruit is shown. Significant increases are also given by treatments 3 and 4 while no material benefit appears to be derived from forking.

The figures for the first crop are as follows (taken as an average of 2 plots).

Yield from Cultural Treatment Experiment.

Treatment.	No. of fruits per acre (mean of two plots)	Average weight of fruit in lbs.
(1) PABCO ...	955.00	3.91
(2) Forked once annually ...	121.6	2.38
(3) Clean weeded ...	238.3	3.58
(4) Pineapple refuse ...	426.6	3.64
(5) Unweeded ...	50	2.57

From the above figures it will be seen that the highest yield, as well as the highest average weight of fruit, is given by the PABCO mulch, the next highest is the pineapple refuse mulch, while the effects of the other treatments are well below each of these.

The effects of mulching are clearly demonstrated by these results, since the control plot has an extremely low yield of 50 fruits per acre only.

It is unfortunate that the cost of PABCO paper is prohibitive, since its use is obviously beneficial. It is however, quite out of the question as a practical means of increasing fertility in Malaya, its cost being in the region of \$250.00 per acre.

In Hawaii, where labour costs are high and weeding therefore expensive and also where PABCO is comparatively cheap, this form of mulch is very successful. The increase in yield over the control obtained from mulches in this experiment, however, inevitably points to the need for some form of cheap mulch, which could be obtained locally, and this matter is under consideration.

The results from this experiment may be compared with those from the manurial experiment. Taking the two highest yields in each case we have:—

Cultural Treatment
PABCO — number of fruits per
acre = 995.0
Pineapple refuse — number of
fruits per acre = 426.6

Manurial Treatment
Treatment No. 6 — number of
fruits per acre = 1466.6
Treatment No. 7 — number of
fruits per acre = 1063.2

These results indicate that a greater effect is given by manuring than by mulching—particularly as the cultural plots were manured with 250 lbs. per acre of a complete mixture of artificials. On the basis of these figures, one would recommend manuring rather than mulching, in order to increase yield, but it would probably be highly efficacious to combine the two. The mulching treatment increases the average size of the fruit while manuring increases the number of fruit as well as the size, so that a combination of both treatments is likely to give the best results.

Attention should again be drawn to the fact that the above figures refer to the first crop only and it is therefore unwise to deduce too much from them at this stage. As a broad indication of the success of the various methods of improving fertility however, they may be regarded as extremely useful, especially as they point the way to the lines along which future experimental work needs to be guided.

Planting Distance Experiments.

There are two experiments devoted to investigations of suitable planting distances for pineapples.

The first of these consists of 24 one square-chain plots. Four different planting distances are adopted, and there are six plots of each of these types.

The four planting distances are :—

1. Double row 2' x 2' x 5' giving 6222 plants per acre.
2. Double row 2½' x 2½' x 5' giving 4620 plants per acre.
3. Double row 3' x 3' x 5' giving 3630 plants per acre.
4. Single row 2½' x 5' giving 3484 plants per acre.

There are two main blocks, each containing 12 plots; these blocks were fertilised with a complete dressing of artificials at 500 lbs. per acre, and 1000 lbs. per acre respectively, applied in two dressings, with a six months' interval.

For purposes of comparison, therefore, we have :—

Four types of planting distance, each repeated 3 times, and each fertilised at the rate of 500 lbs. per acre of a complete mixture.

The same 4 types of planting distance, each again repeated 3 times but each fertilised at the rate of 1000 lbs. per acre of the same mixture of fertilisers.

The complete mixture used is that known as mixture "A" consisting of :—

Sulphate of Ammonia 100 lbs; Basic Slag 300 lbs; Sulphate of Potash 100 lbs. per acre.

Growth throughout the whole experiment has been good, the plots which received the heavier dressing, however, showing the greatest vigour. Also, growth on the more closely planted plots has, throughout the season, been in

advance of the wider spaced planting. The vegetative growth exhibited by the plots planted with pines at 5' x 2' x 2' double row planting and fertilised at 1000 lbs. per acre approximates very closely to that which one might expect on a good loamy soil.

One disadvantage in the close planting, however, should be noted. It is that on light soils of the nature of the plots under experiment, after the plants have attained full height, difficulty is experienced in cultivating between the two close-planted rows. The tendency is for the soil, when being hoed or weeded, to be earthed up on the outside of these two rows only, so that the plants when bearing fruit, become top-heavy and fall inwards. Since this fact has been realised particular care has been taken to see that all cultivation in the early stages is done with the idea of earthing up from the inside of the two rows, so that later, when this becomes difficult, earthing up on the outside only tends to support the plants. Apart from this cultivation difficulty, which is not a serious one, the close planting and harvesting is quite as easy as with the single row method and, if the yield figures support the method, there is no apparent objection to closer planting.

A summary of the first crop yields is given below :—

Yield from Planting Distance Experiments.

Planting Distance.	Number of fruits per acre.	
	Fertilised 500 lbs.	Fertilised 1000 lbs.
Double row 1. 5' x 2' x 2'	540.0	960.0
Double row 2. 5' x 2½' x 2½'	793.0	990.0
Double row 3. 5' x 3' x 3'	686.0	800.0
Single row 4. 5' x 2½'	810.0	650.0

A study of these figures indicates that no definite conclusions can yet be drawn. This is further borne out by consideration of the actual figures of yield for each plot, since there is a wider variation between plots than there is between treatments. The figures for each plot are given below to illustrate this point, and the only conclusion that can be made is that an insufficient number of replicates of each treatment is included in the experiment. The actual soil on which these plots were laid out is of a very variable nature, and also contains certain areas where the original jungle growth was burnt in heaps after clearing. These areas are obvious to the eye and will naturally tend to reduce the accuracy of the results. The actual figures per plot in numbers of fruits are :—

Yields per Plot.

Fertilised at 500 lbs. per acre.			
Planting Distance.	Plot No.	No. of fruits per plot.	Mean per plot.
1. 5' x 2' x 2'	74	62	54
	80	50	
	95	50	
2. 5' x 2½' x 2½'	75	81	79.3
	81	87	
	89	70	
3. 5' x 3' x 3'	84	58	68.6
	85	61	
	92	87	
4. 5' x 2½'	77	67	81
	88	144	
	94	32	

Fertilised at 1000 lbs. per acre.			
Planting Distance.	Plot No.	No. of fruits per plot.	Mean per plot.
1. 5' x 2' x 2'	76	111	96.0
	78	117	
	93	60	
2. 5' x 2½' x 2½'	73	59	99.0
	83	120	
	91	118	
3. 5' x 3' x 3'	82	75	80.0
	87	112	
	90	53	
4. 5' x 2½'	79	49	65.0
	86	96	
	96	50	

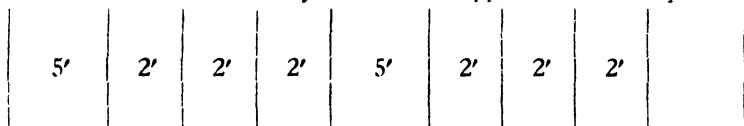
A brief inspection of the above figures will show that the deviation from the mean for one treatment in many cases is greater than the deviation between the mean of one treatment and the mean of another.

It is possible that, with a larger number of fruits, recorded over a considerably longer period, these differences will be reduced to a figure capable of giving a more dependable result, and therefore it will be as well to continue the experiment for some time in order to ascertain if this is the case.

If, after say four crops, the same large discrepancies are shown, the experiment will probably need to be redesigned in order to include a large number of replicates of each treatment.

If the manurial treatment had not been superimposed on top of the planting distance, and all plots had been fertilised alike, there would have been 6 replicates of each treatment instead of 3, with a probable increase in the degree of accuracy.

The second planting distance experiment, is designed to give comparative results between two blocks of pineapples planted very closely, one being fertilised with a complete dressing of artificials at 500 lbs. per acre and the other unfertilised, but both blocks having previously been under green manures. The planting distance adopted is that adopted in some parts of Hawaii *viz.* four rows planted at two feet apart with two feet between plants (diagonal planting) and then a wide row 5 feet away. The rows appear thus when planted :



There are ten one sq. chain plots in each block and all the area was planted as above in November 1932. The fertiliser mixture applied was the standard complete mixture "A" consisting of Sulphate of Ammonia 100 lbs.; Basic Slag 300 lbs.; and Sulphate of Potash 100 lbs. per acre.

Growth on all plots in this area since planting has been good, the fertilised half being better than the unfertilised half, and this experiment should yield useful data on the subject of close planting in due course.

Variety Trials.

(a) The variety trials consist of one small area under Mauritius pines and one similar area under Sarawak pines, in addition to 100 plants of each of the following varieties :—

- (1) Kew,
- (2) Bogor,
- (3) Conte de Paris,
- (4) Ruby,
- (5) Montserrat,
- (6) Hitam or Merah.

Of the above the following have so far produced fruit : Sarawak, Mauritius, Bogor, Ruby and "Hitam" or "Merah".

Study of the plants during the growing period and in fruit has led to the following conclusions :—

- (1) The Kew pine is the same as the Sarawak pine.
- (2) The "Bogor" pine is the same as the Mauritius pine, ("Bogor" is the Javanese name for this variety).
- (3) "Ruby" is probably another name for the Singapore Queen pine. No important differences between the two varieties have been noted.
- (4) Of the varieties planted the only one likely to be of commercial importance in Malaya for canning, is the "Ruby" variety.

All other varieties have spiny leaves which make cultural and harvesting operations so difficult that they are not likely to be adopted for field planting on a large scale.

(b) In addition to the above varieties, one hundred plants of the Smooth Cayenne variety obtained from the Department of Agriculture, Java, have been planted out for observation. It is believed that the Smooth Cayenne is either the same as the Sarawak, or a closely allied form.

Recently also it was learnt that two types of Sarawak, one large and one small, are known in Singapore. One hundred suckers of the small variety have been planted out alongside the Smooth Cayenne for comparison purposes.

(c) An attempt at crossing the female Sarawak with the male "Queen" pine resulted in a number of seeds being produced in the ripe fruit. Of these seeds four have since germinated and are being kept under observation in pots.

(d) Selection of the best plants for propagation, with a view to improvement of general quality, yield etc., has recently been started.

Disease Experiments.

A small scale experiment to determine whether the apparent "wilt" noticed on certain pineapple plants was due to soil poverty or to actual attack by specific disease was conducted during the season. The results of this experiment indicated that it is probable that the so-called "wilt" is caused by lack of sufficient plant nutrients. The experiment is to be repeated.

Periodic examinations of "wilted" plants in the Research Laboratories of the Department have been carried out and in no case was a specific disease due to a micro-organism identified.

APPENDIX.

The results obtained in the foregoing article were submitted to statistical analysis to ascertain whether the various increases obtained with different comparable treatments were of significance or whether they were due to chance.

The three experiments examined were (i) Manurial, (ii) Cultural, (iii) Planting Distances.

The application of the "z" test* shewed that only the first two of these experiments were significant. In the planting distance experiment the random variance was three times greater than the treatment variance and therefore the experiment was without significance.

Subsequent application of "t" test† to the manurial experiments gave the following figures for the usual standard of significance $P = .05$ (only a five per cent. likelihood of such results occurring by chance).

Significant difference between any treatment and control = 19 fruits.

Significant difference between any two treatments = 23 fruits.

The mean yields per plot for the 12 treatments were as follows:—

Treatment.	Mean yield in number of fruits.
(1) $\frac{1}{2}$ ton lime	7 $\frac{1}{2}$
(2) $\frac{1}{2}$ ton lime, Sulphate of Ammonia 100, Superphosphate 300, Sulphate of Potash 100	38
(3) As (2) + Magnesium Sulphate 240	36
(4) Control	8
(5) Superphosphate 300, Sulphate of Ammonia 100, Sulphate of Potash 100	46
(6) As (5) with double Sulphate of Potash	73
(7) As (5) + Magnesium Sulphate 240	61
(8) Superphosphate 300, Sulphate of Potash 100	28
(9) Superphosphate 300, Sulphate of Ammonia 100	37
(10) Sulphate of Ammonia 100, Sulphate of Potash 100	13 $\frac{1}{2}$
(11) Pineapple Refuse 10 tons	15
(12) Cattle Manure 10 tons	35

* "z" Measure of the ratio of random variance and variance between treatments (and varieties) calculated as $\frac{1}{2} \log_e \frac{\text{Treatment Variance}}{\text{Random Variance}}$.

† "t" Measure of the observed difference between two treatments to the standard deviation.

From these figures of mean yield it will be seen that all treatments shewed significant increase over control except (1) Lime, (10) Sulphate of Potash, (11) Pineapple Refuse. All treatments which shewed significant increases over control were of higher order than $P = .05$ except (8).

The layout of the experiment was in three randomised blocks each treatment appearing twice in each block. Results further shewed some difference in fertility between blocks.

In the cultural experiment application of the "t" test shewed, for the usual standard of significance of $P = .05$:—

For significant increase of any treatment over control (unweeded) 53 fruits.

For significant increase between any two treatments 78 fruits.

The mean plot yields for each treatment were as follows :—

Treatment.	Mean Plot Yield.
(1) PABCO mulch	293
(2) Forked once yearly	37
(3) Clean weeded	72
(4) Pineapple mulch	128
(5) Unweeded (as control)	15

From these figures it will be seen that PABCO mulch was highly significant over all other treatments. Pineapple mulch was significant over treatments 2 and 5 while clean weeded shews significance over unweeded.

BLEACHING OF PALM OIL AT SERDANG,

BY

C. D. V. GEORGI,

Acting Agricultural Chemist

and

T. D. MARSH,

Assistant Agriculturist.

Introductory.

The present article gives an account of some additional experiments carried out on a semi-commercial scale in the oil palm factory at the Government Experimental Plantation, Serdang regarding the bleaching of palm oil, to which reference was made in a previous number of this Journal.*

In that article an account was given of the various methods employed for bleaching the oil, attention being drawn specially to the possibilities of air-bleaching with a catalyst, for example, cobalt borate.

Using this catalyst the experiments at Serdang have shown the possibility of the production of a bleached palm oil of good quality without the installation of an expensive plant.

Description of Plant.

A small iron tank, having a working capacity of approximately 1200 lbs. of oil, has been installed close to the De Laval separator. The tank is fixed at such a height that the oil after treatment can be discharged by gravity to the separator.

The tank is provided with a closed steam coil for heating the oil, also with a perforated pipe through which air from a blower can be injected into the heated oil. The blower is actuated by means of a small electric motor.

A supply tank, which can be filled from the De Laval separator, is fixed below the bleaching tank, the oil being raised by means of a hand-pump. The supply tank is calibrated, so that the amount of oil pumped into the bleaching tank can be calculated.

Description of Process.

The purified oil from the De Laval separator is pumped into the bleaching tank and the oil heated to a temperature of 90°C. Air is injected into the oil, the rate being adjusted so that the contents of the tank are maintained in a gentle state of agitation.

Owing to the air not being heated the temperature tends to fall a few degrees, and the steam supply is therefore increased slightly in order to maintain the oil at the required temperature.

* *Malayan Agricultural Journal*, Vol. XXI, No. 1, January 1933.

Cobalt borate is added to the oil in the proportion of 20 grammes (approximately $\frac{3}{4}$ ounce) to every 400 lbs. of oil in the tank. The cobalt borate should be finely powdered and dusted over the surface of the oil.

As regards the colour of the oil, little change will be observed during the first hour, the colour becomes, however, distinctly lighter towards the end of the second hour. It is at this stage that the change in colour must be carefully followed, experience having shown that the change is rapid and it is easy to carry the process too far, with the result that the oil loses its bright appearance and is apt to develop a dull greyish tint.

A satisfactory method of judging the change in colour consists in withdrawing at regular intervals, every 10 minutes, a small amount of oil, placing it in a thin glass test-tube and cooling the latter in iced water. Under such conditions the oil solidifies, and by taking a series of samples the change in colour from yellow to the faint yellowish-white tinge, which represents the optimum colour of the bleached product, through to the greyish tinge can be easily traced. The time required is approximately $2\frac{1}{2}$ hours.

Since a small amount of flocculent matter separates out in the oil as a result of the treatment the bleached oil is therefore allowed to cool slightly and passed through the De Laval separator in order to free the oil from any matter in suspension.

It does not appear feasible to attempt to recover the catalyst.

General.

Supplies of cobalt borate are not available in Malaya, and the catalyst must be ordered from manufacturing chemists in England. Among these firms may be mentioned The British Drug Houses Ltd., City Road, London, N. 1.

As far as can be ascertained the price of cobalt borate would be approximately \$5 (Straits currency) per lb. Although the price may seem high it must be remembered that 1 lb. of the catalyst is sufficient to bleach 24 barrels of oil, so that the cost of catalyst per barrel is only approximately 20 cents.

While the method is not complicated, it must be emphasised that, if regular results are to be obtained, the conditions of bleaching must be maintained constant.

Previous experiments showed that the period of bleaching varied with the temperature and the amount of air. If, however, a series of tests is conducted as indicated above and the period for the complete bleaching effect noted, then by maintaining the same conditions it should be easy to regulate the process so as to ensure a standard product.

As far as can be judged, the bleaching effect is permanent, the colour showing no tendency to return even after the oil has been stored for more than one year.

In conclusion, it may be mentioned that demonstrations of the process will be given on application to the Senior Assistant Agriculturist, Government Experimental Plantation, Serdang.

Reviews.

The Valuation of Tuba Root

BY

C. D. V. GEORGI, O.B.E., B.SC., F.I.C. and GUNN LAY TEIK, B.A.

Department of Agriculture, S.S. and F.M.S.

Special Bulletin, Scientific Series No. 12, 30 pp. 1933.

Price 50 cents (Straits).

The increased interest being taken in tuba root for insecticidal purposes and the lack of any marked features by which the roots can be distinguished render chemical valuation desirable, at any rate until further information is available regarding both the optimum conditions of cultivation and harvesting for the different species of *Derris*.

In the publication just issued the authors point out that, while in the case of consignments for export the analysis of the roots is gradually becoming the usual practice, the results of the analysis are not apparently used as the basis on which the product is valued.

At present there are two standards on which the roots are sold, *i.e.* the amount of matter extractable by a solvent, usually ether, and the rotenone content. Rotenone is one of the specific toxic compounds known to be present in the roots. The solvent extract determination is usually required in the case of the roots exported to Europe, while the rotenone content is the basis for roots shipped to the United States of America.

Full details are given of the methods of analysis for both the amount of solvent extract and of the rotenone content. While the determination of the solvent extract offers no difficulties, the method for the estimation of rotenone is undoubtedly only approximate. It should not be difficult, however, to decide upon a standard procedure which would be acceptable to all concerned.

Under such conditions, it would seem only reasonable that the results of analysis should be used as the basis of valuation, a standard price being paid for roots containing definite amounts of either solvent extract or rotenone with a fixed rate of premium or discount according to whether the amount shown by chemical analysis is greater or less than the specified figure.

(A. T.)

Tapioca in Malaya

BY

V. R. GREENSTREET, F.I.C., and J. LAMBOURNE.

*General Series : Bulletin No. 13 : Department of Agriculture, S.S. and F.M.S.**76 pp. 24 plates : price \$1 (Straits).*

This Bulletin should prove to be a welcome addition to existing literature on the tapioca industry since it presents in its 76 pages a comprehensive account of the present condition of the industry in Malaya along with up to date information relating to progress achieved as a result of experimental work conducted by the authors and the staff of the Department of Agriculture in Malaya.

Tapioca has always been regarded in Malaya as a crop which is exceedingly exhausting to the soil in which it is grown. In fact a ruling made in the year 1927, allowing the cultivation of not more than two crops of tapioca on land alienated for rubber or other form of permanent cultivation, is still in force. It is pointed out, however, in the Bulletin under review, that the ill reputation which tapioca has borne and still bears, is in reality due to the manner in which the crop is cultivated, and it is stated that "once the necessity for rational methods of cultivation and manuring in relation to it are realised, there is no reason why the crop should not be grown continuously, or preferably in rotation with other crops, for an indefinite period on the same land not only without harm but probably with actual benefit to the soil by reason of the deeper and more thorough tillage which its cultivation necessitates".

The Bulletin, which is profusely illustrated, is divided into Chapters under the following headings:—Historical, Botanical, Cultivation, Soil Impoverishment and Manuring, Diseases and Pests, Tapioca Products and their Manufacture, Cost of Production, Tapioca Products and their Uses, Trade.

A useful key to the classification of the different varieties is included in the Botanical section, where also the important question of the prussic acid content of the varieties is discussed.

In the section devoted to manufacture of the tapioca products produced in Malaya i.e. tapioca flake, pearl, starch (flour) and refuse, a full account is given of the methods employed locally. It is shown that the average Malayan grades of edible tapioca compare unfavourably with those produced in Java where the industry is on a far larger scale than in Malaya.

(W. G. H.)

**Observations on a Lac Insect (*Laccifer javanus* Chamb.) and an
Account of Attempts to Propagate it.**

BY

N. C. E. MILLER, F.R.E.S.

*Lac in Malaya, Part 1, 3 pls. Special Bulletin, Department of Agriculture,
S.S. and F.M.S., Scientific Series, No. 11, 1933.*

Price 50 cents (Straits).

This paper contains descriptions of a lac producing insect—*Laccifer javanus* Chamb., and also reports, *in extenso*, received from the Imperial Institute, London, on the quality of the lac and its market possibilities.

The insect in its various stages, its parasites and certain other insects associated with it are figured, and an account of attempts to propagate it on a large scale in its natural habitat on its original host tree *Macaranga megalophylla* M.A. are described.

The attempts at propagation, owing to many opposing factors among which the most important are parasites, were unsuccessful. It is intimated that, as there are possibilities that the species (*Tachardia lacca* Kerr.), which has been cultivated in India for many years, might adapt itself to local conditions it is intended to import sufficient brood lac for experimental purposes.

Investigations on *T. lacca* will, it is hoped, be published later as Part II of "Lac in Malaya".

(W. G. H.)

Abstracts.

FIFTEENTH REPORT ON NATIVE RUBBER CULTIVATION.

2nd Quarter 1933.

Prepared by the Bureau of Agricultural Economics of the Division of Agriculture of the Netherland Indian Department of Agriculture, Industry and Commerce, at Buitenzorg, August, 30th, 1933.

General review.

The prices, which during the second half of March fluctuated at an even level, increased regularly during the second quarter of 1933; the Batavia quotations rose from $6\frac{1}{2}$ florin cents per $\frac{1}{2}$ kilogram of Java Standard sheet in March to $12\frac{1}{8}$ florin cents in the first week of June. After a drop to $9\frac{7}{8}$ florin cents on June 17, prices rose again to 14 florin cents in July.

Causes for the increase in prices during April included the firmer tone on the American produce market, the persistent reports concerning a new attempt for rubber restriction and the uncertainty in the American rate of exchange. The news relative to a controlled inflation, restriction rumours, the increase in American consumption and the preparations for the World Economic Conference made the higher prices last until about the middle of June, when prices weakened as a result of an unfavourable report from London regarding restriction. This temporary decline, however, was followed by a rather sudden rise again.

The export of native rubber from Netherland India reacted sharply to the rising prices with the result that the drop in monthly exports, noted since November, 1932, came to a halt with the trend in exports showing a striking increase. During the first quarter of 1933 the exports of native rubber totalled 13,420 metric tons of dry rubber. In the second quarter, however, the export amounted to fully 25,417 metric tons, which total was not reached during any quarter of 1931 or 1932.

When calculated over a whole year the high July export of native rubber from Netherland India works out at an annual export of about 150,000 metric tons. It should be noted, however, that this total remains far behind potential production which for 1933 may conservatively be estimated at 300,000 metric tons.

As might be expected, the reaction of the prices on production in the native rubber cultivation in Netherland India was greatest in those areas where production dropped off most sharply during 1931 and 1932. The reaction was less noticed in those areas where production has been maintained due to the necessity of the native population to keep to rubber due to the lack of other means of livelihood. In this connection, attention may be drawn to the fact that in Djambi and in the Western Division of Borneo, although production was

decidedly affected, the increase in production was relatively less than in Palembang, in the Southern and Eastern Division of Borneo, and elsewhere.

The rubber remilling industry in both divisions of Borneo showed a greater degree of activity; the export of dry rubber from the Western Division of Borneo increased from 1,037 metric tons during the first quarter of 1933 to 1,515 metric tons during the second quarter. For the Southern and Eastern Division of Borneo the respective figures were 960 and 1,348 metric tons. In Tapanoeli, the production of blanket rubber increased from 70 to 175 metric tons. There are no reports covering rubber remilling activities in other areas.

Reports from various producing areas.

Acheen and Dependencies.

The higher prices during the second quarter caused a larger export. Prices at Langsa for wet slabs showed the following trends, prices being shown in florins per 100 kilograms:

Prices at Langsa in florins per 100 kilograms.

April 8, 1933	...	...	Fl. 3.00	—	Fl. 3.70
April 22, 1933	...	...	„ 3.00	—	„ 3.70
May 6, 1933	...	...	„ 4.60	—	„ 5.00
May 20, 1933	...	...	„ 4.60	—	„ 5.80
June 8, 1933	...	...	„ 8.30	—	„ 10.00
June 24, 1933	...	...	„ 6.60	—	„ 8.30

In spite of the higher prices, the production of rubber still remains a secondary occupation, even in the leading producing centres. Although in June tapping was again taken up in the gardens near Langsa as well as in deserted plantings in other areas, it is estimated that only about 10% of the total tappable area is under regular production.

Tapanoeli.

The export from Sibolga during the 1933 second quarter totalled 261 metric tons of dry rubber, consisting partly of sheety crepe, of the "sam-sam" or mixed qualities, and partly of blankets. Rubber from Padang Sidempoean and Kota Nopan is also shipped via the West Coast of Sumatra to Pakan Baroe. The amount of rubber shipped in this manner is not known exactly although it is in important amounts. During the second quarter in Tapanoeli a total of 175 metric tons of blankets were prepared against 70 metric tons in the first quarter.

The price on the Sibolga market in April amounted to 6½ florin cents per kilogram; it was as high as to 15 florin cents on June 26.

Tapping was resumed in the gardens located in favorable situations but the upkeep of the gardens is still not receiving much attention.

Sumatra West Coast.

The export from Padang totalled 2 metric tons; Bangkinang exported 271 metric tons via Pakan Baroe and Batang Hari and Sidjoendjoeng exported 185 metric tons via Djambi; the export from Loeboek Sikaping and from the Ophir districts via Sumatra East Coast Province is not known.

In addition to the price increase, in the subdivision of Bankinang, where tapping activities were increased by more than three times, it is reported that the low rice stocks also caused rubber production to be greater.

In this district also does the rubber cultivation remain of small significance in the native economy. It still represents an enterprise of secondary importance, the production of foodstuffs being considered much more important. Higher rubber prices will undoubtedly cause the native producers to again regard rubber as being more important than at present.

Palembang.

Calculated on a dry rubber basis, the exports of rubber from Palembang during the second quarter totalled 2,200 metric tons against 1,300 metric tons during the 1933 first quarter. The increase in exports is shown more clearly by the monthly export figures, as follows: 560 metric tons in April; 739 metric tons in May; 929 metric tons in June and 1,700 metric tons in July.

The number of tappers increased appreciably and more than doubled during the six week period from mid-May to the end of June. The area in tap was enlarged upstream by means of which the gardens most favourably located were taken into tap first.

The increase in production is entirely due to the rise in prices. Locally, speculation caused prices to rise even above the Singapore parity. Thus, for example, in the Lematang "margas" ("margas" equivalent to a collection of villages) the price increased to Fl. 10.00 per 100 kilograms of slabs by June 17 after which a decline took place to Fl. 7.00 in sympathy with a drop in prices in Singapore of 2 1/16 cents per kilogram; in general after the second week in June a price of Fl. 7.00 per kilogram was paid.

Djambi.

The export during the 1933 second quarter totalled 5,200 metric tons of dry rubber against 3,800 metric tons during the 1933 first quarter. The monthly export figures, show a decided reaction as a result of the rise in prices; this is not as strong, however, as in other regions since the monthly exports from Djambi have been large even with low prices prevailing. The export for July is about 2,400 metric tons (dry).

In May, according to a report received from the Resident, not more than 10% to 20% of the total planted area, which is estimated to include more than 260,000,000 trees, was in tap. Of the total planted area, it is reported that at the present time about half of the trees are of tappable age and that next year about two-thirds will be of tappable age.

Western Division of Borneo.

The export, calculated in terms of dry rubber, increased from 4,048 metric tons during the 1933 first quarter to 7,611 metric tons during the 1933 second quarter. The monthly export figures were as follows: April—1,662 metric tons; May—2,823 metric tons; June—3,126 metric tons; and July—about 2,900 metric tons. The rubber remilling industry showed greater activity; the

export of dry rubber was increased from 1,037 metric tons during the 1933 first quarter to 1,515 metric tons during the 1933 second quarter.

The price increase was naturally the prime reason for the larger export. This was not the only reason, however, since many labourers were available because the rice harvest had been completed. A dry period also helped the native producers to tap rubber more expeditiously.

Southern and Eastern Division of Borneo.

The export from this division during the second quarter of 1933 was three and one-half times as great as during the first quarter of 1933. Monthly exports for the first seven months of the year were as follows: January—647 metric tons; February—498 metric tons; March—619 metric tons; April—955 metric tons; May—2,344 metric tons; June—3,080 metric tons; and July about 3,300 metric tons. This very appreciable increase in exports is due to the fact that the greater part of the rubber cultivation in the Southern and Eastern Division of Borneo is concentrated in the thickly populated Oeloe Soengei district and so the necessary labour forces could be secured without difficulty.

The export of dry native rubber increased from 960 metric tons during the 1933 first quarter to 1,348 metric tons during the 1933 second quarter. During June, two remilling plants, with a combined capacity of 550 metric tons a year, were put back into operation. The Nomura company, during the second quarter, bought up 222.5 metric tons of dry native rubber, about three times the amount bought up during the 1933 first quarter.

The total amount of business done at Amoentai during the 1933 second quarter involved 2,611 metric tons against only 180 metric tons during the 1933 first quarter. The local Netherland India officer in the subdivision of Barabai reported that tapping during May reached a point not even reached during the "Hausse" or boom times. Even so, it is reported that fully two-thirds of the areas are not being tapped and an important part of these areas has never yet been tapped.

Kiouw and Dependencies.

The monthly export from inside the Netherland Indian customs territory of this district was as follows during the first half of 1933: January—502 metric tons; February—355 metric tons; March—394 metric tons; April—391 metric tons; May—729 metric tons; June—840 metric tons; and July—807 metric tons. These figures show a quick increase beginning with May.

P.S.—The rubber export figures in August, received by telegraph from the principal ports, show a decrease in exports of native rubber in the month of August. They may be estimated at about 11,400 metric tons (12,700 tons in July). Causes for this decrease may be found in the declining prices since July, but also in the speculative character of rubber trade, through which price movements in the interior are accentuated; also possible increasing stocks, in the hope of recovering prices, might have been of influence.

TEA PROPAGANDA BY CARAVAN IN CEYLON.

The following extract, which is taken from the Planters Journal and Agriculturist, August 1st 1933, is published for the information of those interested in the work of the Rural Lecture Caravan in Malaya.

"The Ceylon Tea Propaganda Board recently took delivery in Colombo of a motor caravan which, handsomely appointed with every conceivable accessory, will tour the roads of Ceylon, her crew of eight spreading tea propaganda to the populace. The caravan is constructed on a Commer Raider chassis and built locally by Rowland's Garage in Colombo. A tent, attached to the hood, when erected provides sleeping accommodation for four, the folding beds being carried in the caravan. The caravan carries—for use in the Tea Propaganda—60 cups and saucers, kettles, teapots, 300 lbs. of tea in packets, 3 stoves, 4 portable tables, 7 chairs, trays, banners, banner-holders and megaphones. These last, aided by an 8-valve wireless set fitted with a loudspeaker and microphone, and 2 gramophones, will be of the greatest help to the propaganda crew when addressing large crowds. The roof signboard bears on one side Sinhalese, and on the other, Tamil characters to the effect "Drink good Ceylon Tea." It is floodlit at night. In travelling trim with a full load and crew aboard the caravan weighs $3\frac{1}{2}$ tons. Its water tank has a capacity for 60 gallons, and 30 gallons of petrol may be carried. Seven electric batteries and two dynamos provide the current necessary for lighting brightly the interior of the caravan. The caravan is very compact and seems to be entirely independent as to where it camps or moves about. It will be of immense value to the propaganda Board in their local Tea advertising campaign and should have the desired effect of increasing local tea sales. It is understood that this is the first of a fleet of similar caravans to be put into use later on."

Departmental.

FROM THE DISTRICTS.

The Weather.

In most parts of the Peninsula the rainfall for the month was below average, the weather in general being hot and dry for the first three weeks with rain during the last week. In Province Wellesley and Selangor there were also showers during the first week of the month, while in South Kedah showers were more frequent and more evenly distributed.

In the meteorological area embracing the coast of the Negri Sembilan and the whole of Malacca Settlement the rainfall was heavier and normal for the month.

In Johore and Singapore the weather was hot and showery, though precipitation in Johore was on the whole below the average, especially in the Batu Pahat District.

No information from the East Coast is yet available.

Remarks on Crops

Rubber. There was a slight decline in the average price of rubber during the month. The highest and lowest prices in dollars and cents per picul recorded during the month for rubber from small holdings were :—Smoked Sheet \$10 to \$16; Unsmoked Sheet \$7 to \$15; Scrap \$1.50 to \$8. The average Singapore prices recorded for small-holders' rubber were :—Smoked Sheet \$15; Unsmoked Sheet \$14; Scrap \$5.50, as compared with \$15, \$14 and \$6 in August. The Penang prices for Unsmoked Sheet ranged from \$11.50 to \$13.50 against \$13 to \$15.50 in August.

In spite of the slight further decline the present price of rubber appears to be remunerative to small-holders, since there has been a further increase in the number of holdings tapped in almost all parts of the Peninsula.

In other respects the situation remains the same as in August. The control of Mouldy Rot disease continues to receive attention and there has been a wider distribution and increased use of the approved disinfectants.

Padi. The price of padi at the Government Rice Mill, Bagan Serai was \$1.70 per picul as compared with \$1.80 in August. In Kedah, however, the price rose somewhat varying from \$10.50 to \$16 per kuncha (160 gantang). These prices are equivalent to 7 and 6½ to 10 cents per gantang respectively. In some districts where little padi is grown the price was as high as 12 cents per gantang.

Padi planting has progressed well in Kedah, Province Wellesley and Krian. In some parts of Perak planting has been delayed by drought and areas already planted have suffered from lack of water. Drought has also delayed planting in Kuala Selangor District. In the Negri Sembilan preparation of the land and planting made better progress in Kuala Pilah District and in the coastal area of Malacca more favourable weather enabled planting operations to be nearly completed.

In the inland districts of Selangor harvesting of the short-term padi was in progress and on the whole good crops were being obtained.

In Johore padi planting takes place at very different times even in the same locality and the mixed strains of padi used vary much in their maturation period. Consequently, ripening is very uneven and the crop suffers severely from the ravages of birds, as has been experienced during the harvest now in progress in Batu Pahat District.

Coconuts and Copra. There has been a further considerable decline in the price of copra, prices in various centres during the month ranging from \$2 to \$3.60 per picul, with Penang prices \$2.80 to \$3.30 and the average Singapore price \$2.75 per picul.

In spite of the low price the interest of Malays in the production of improved copra has been well sustained. A new kiln has been built on approved lines at Alor Star, Kedah. Apart from this there is little to add to the review of the position given last month.

A small group of palms in the Sungei Star area in Krian was attacked by the *Zygaenid*, *Artona catoxantha*; the control measures recommended were carried out and the attack ceased.

Fruit. Rambai were fruiting heavily at Kampong Paoh in Larut District. In the mukims of Budu and Tanjong Besar in Kuala Lipis District of Pahang fairly good crops, more especially of langsung, were harvested. For about two weeks between 4 and 6 lorry loads were sent to Kuala Lumpur daily. In Johore Duku and Rambai were still in season. Elsewhere the fruit season had terminated.

There is a flourishing banana industry in the Batu Pahat District of Johore. It is estimated that some 50 tons of bananas are sent by lorry to Singapore each week. The varieties sent are cooking bananas and the eating variety known as Pisang Masak Hijau. The growers are mostly Javanese.

Tobacco. Prices for dried tobacco leaves ranged from \$20 to \$45. and showed a slight decline. The planted area is being extended in Baling District of Kedah, Kinta District of Perak, where in one locality alone some 500 acres are planted, in Raub District of Pahang and in the Serangoon area of Singapore. In the Batu Pahat District of Johore large quantities of leaf were being harvested and good samples of prepared yellow leaf grown and cured by Javanese were to be seen in several places.

Agricultural Stations.

At all Stations good progress has been made in the planting up or supplying of plots of permanent crops such as tea, coffee, fruit trees, cloves and nutmegs; a number of plots of temporary crops have also been planted. Plots of vegetables and annual crops have been reaped; much of this produce will be distributed as planting material to School Gardens. The tobacco harvest was in progress at the Kuala Kangsar and Temerloh Stations and satisfactory crops were being obtained. At the Pineapple Experiment Station in Singapore trials of vegetative methods of reproducing fruit trees known to be of good quality were in progress. These included planting cuttings, marcotting, budding and the use of the etiolation method. It is becoming necessary to build up an adequate stock of young fruit trees of good quality at this Station which already has to meet a growing demand for such planting material.

It is reported that good progress has been made in the establishment of the combined Agricultural Station and Padi Test Plot at Brunei. Pending the arrival of Malay officers now in training at the School of Agriculture, Serdang, the District Officer is supervising the work on this Station with the advice and assistance of the Agricultural Field Officer, Singapore, who visited Brunei in August and took with him supplies of planting material for this Station.

Padi Stations and Test Plots.

Work on these Stations and Plots continued normally. Planting was completed at the Telok Chengai Station in Kedah and at Pulau Gadong Station and the Padi area at Sungei Udang Station in Malacca. Reaping was commenced on the Kajang and Kuang Padi Test Plots in Selangor. On the former Plot satisfactory yields were obtained from Radin Siak, F.S. 27, F.S. 756, Padi Kelantan and Padi Acheh, but on the Kuang Plot yields from the same strains and varieties appeared to be low. Radin Siak suffered severely from the ravages of birds which appear to be especially partial to this strain.

School and Home Gardens.

The half yearly classification of School Gardens in Penang and Province Wellesley was held on August 28th to 30th, judging being done by the Agricultural Field Officer, the Malay Assistant Inspector of Schools and the Malay Agricultural Assistant in each district. As a result seventeen schools obtained between 80 and 100 marks, thirteen between 70 and 80 marks and seven between 60 and 70 marks. The highest marks were obtained by Sungei Nibong School with 94 $\frac{1}{2}$ and Bayan Lepas with 92.

A large number of home gardens have been made by school children in Selangor, mainly as a result of District competitions. These competitions not only encourage the planting of vegetables in small holdings belonging to the parents but, if the gardens are well kept, have a considerable effect on the whole population of the village.

Many of the gardens reach a high standard of excellence and are a credit to their owners and the advisory officers.

General.

Carp Rearing. A Malay at Budu in the Kuala Lipis District of Pahang started an experiment in carp rearing towards the end of 1932. The fish with which he was then supplied have reached a weight of 2 — 2½ katies and are doing extremely well. The owner of these two ponds is extending his operations and another Malay in the same district has asked for 2,000 fry. Enquiries have also been received from two sources in Raub. This is a minor industry which might well be more widely adopted by Malays in localities where supplies of fish are difficult to obtain.

Kelantan Match Factory.

The Acting British Adviser, Kelantan, has provided the information that this factory is making match sticks prepared from the wood of rubber trees thinned out from rubber estates. This rubber wood gives a fairly satisfactory match stick, but is considerably harder to cut than either the local or Japanese timber usually employed for this purpose.

DEPARTMENTAL NOTES.

Visits and Tours.

The Director of Agriculture, Dr. H. A. Tempany, C.B.E., paid a visit to Fraser's Hill from September 9th to 11th and inspected the Dairy and Poultry Farm. He also visited Cameron Highlands from September 28th to 30th, discussed agricultural matters with the officer-in-charge of the Experiment Station, Tanah Rata, and made a tour of some of the recently opened areas in the Highlands.

Mr. A. Thompson, Acting Govt. Mycologist, visited Cameron Highlands from September 17th—20th in connection with diseases of certain crops in this region.

Major C. D. V. Georgi, O.B.E., Acting Agricultural Chemist, visited an Oil palm estate in Negri Sembilan, to give advice on problems connected with factory practice.

The Director, accompanied by Mr. F. W. South, Chief Field Officer, Mr. R. B. Jagoe, Acting Economic Botanist, Mr. J. A. Simpson, Agricultural Field Officer, Selangor, and Mr. W. H. Barnes, Poultry Instructor, visited Kajang District Agricultural Show, on October 1st.

Malayan Pineapple Industry.

The Director addressed the Kuala Lumpur Rotary Club on the subject of the Malayan Pineapple Industry on September 6th.

Staff Charges and Leave.

Mr. F. W. South, Chief Field Officer, returned from leave and resumed duty on 2nd September, 1933.

Mr. F. Birkinshaw, Acting Chief Field Officer, returned to Taiping and resumed duty as Senior Agricultural Officer, Perak, on September 11th.

Mr. F. R. Mason, Agricultural Field Officer, has been seconded for service under the Government of Johore as Acting Principal Agricultural Officer, with effect from 13th September 1933.

Mr. A. E. Colman Descas returned from leave and assumed duty as Agricultural Field Officer, Negri Sembilan, on September 2nd.

Mr. J. Fairweather, Principal Agricultural Officer, Johore, has been granted full pay leave of 8 months and 7 days from September 15th.

Mr. R. G. H. Wilshaw, Agricultural Field Officer, has been granted full pay leave of 7 months and 24 days from September 2nd.

Statistical.

MARKET PRICES

September 1933.

Rubber.—The market price was fairly steady during the month, opening at 12 3/16 cents per lb. for Spot loose in Singapore and closing at 12 6/16 cents per lb. The average price for the month was 11 15/16 cents per lb. in Singapore, 3 11/16 pence in London and 7 cents Gold in New York as compared with 12 3/16 cents, 3 13/16 pence and 7½ cents Gold respectively in August.

Palm Oil.—The course of the English market during September on a basis of 18 per cent., f.f.a., c.i.f. Liverpool was as follows:—September 1st £16.15.0 per ton, market quiet, September 8th £16.10.0 per ton, market dull, September 14th £16.10.0 per ton market steady and September 28th £15.15.0 per ton market easy.

Prices in the U.S.A. landed weight per pound in bulk c.i.f. New York/Philadelphia were 3.40 cents Gold on the 9th September; 3.25 cents Gold on the 16th September; 3.30 cents Gold on the 23rd September and 3.20 cents Gold on the 30th September.

The price of palm kernels Fair Average Malayan Quality c.i.f. landed weight on the Continent was Shillings 8/1½ per cwt. on the 9th September; Shillings 7/7½ on the 16th; Shillings 8/- per cwt. on the 23rd, and Shillings 8/- per cwt. on the 30th September.

Copra.—There has been a slight fall in price during the month. The highest Singapore price for Sundried during September was \$3.55 per picul, and the lowest price \$3.30 per picul, the average price being \$3.42 per picul as compared with \$3.70 per picul during August.

The mixed quality averaged \$2.87 per picul as compared with \$3.13 in August.

Coffee.—The price at Singapore for Sourabaya coffee was steady and was similar to ruling prices in August. Prices ranged according to grade, from \$17.50 to \$19.50 as compared with \$16 to \$19 during August. Palembang coffee averaged \$12.75 during the month being quoted at \$12.50 on the 1st and \$12.50 on the 29th the average figure for September was \$12.75.

Arecanuts.—Palembang's averaged \$2.27 and Bila Whole \$2.15 per picul as compared with \$2.49 and \$2.37 during August. The range of Singapore prices for other grades was:—Split \$2.25 to \$4; Red Whole \$3 to \$4.50. Sliced \$10 to \$12.50, and Kelantan \$2.50 to \$3.50.

Gambier.—There was a slight fall in price of Block Gambier during September, the average price being \$4.50 per picul, Cube No. 1 averaged \$7.50. Corresponding figures for August were:—\$4.75 and \$8 respectively.

Pineapples.—Values again firmed slightly during September, the average Singapore price per case being : Cubes \$3.30, Sliced Flat \$3.30 and Sliced Tall \$3.30 as compared with \$3.26, \$3.16, and \$3.25 during August.

Tapioca.—The price of Flake Fair averaged \$4 as compared with \$3.95 in August. Pearl Seed averaged \$5, the average being similar in August, and Pearl Medium averaged \$5 the average price being similar in the previous month.

Sago.—Pearl—Small fair fell in price to \$4 during the month, Flour-Sarawak fair averaged \$1.77 as compared with \$1.83 in August.

Macé.—Prices ruling during the month were similar to August prices, namely \$70 per picul for Siouw and \$50 for Amboina.

Nutmegs.—Prices were steady during the month. Singapore price per picul for 110's was \$20 a similar price was obtained during August, and 80's averaged \$26 having averaged \$26.50 in the previous month.

Pepper.—Average Singapore prices during September were as follows :—Singapore Black \$13.12 per picul; Singapore White \$21.94 and Muntok White \$22.56, the corresponding figures for July were \$13.19, \$23.12, and \$23.75 respectively.

Cloves.—As previously, the demand for cloves remains small, nominal prices being \$40 for Zanzibar and \$45 per picul for Amboina.

GENERAL RICE SUMMARY.

August 1933.

Malaya.—Gross foreign imports of rice (including stocks available for re-export) during August 1933, amounted to 57,930 tons, as compared with 47,430 tons in August 1932, of which 46 per cent. were consigned to Singapore, 18 per cent. to Penang, 9 per cent. to Malacca, 21 per cent. to the Federated Malay States and 6 per cent. to the Unfederated Malay States.

Of these imports, 58 per cent. were from Siam, 40 per cent. from Burma, 1 per cent. from Indo-China and 1 per cent. from other countries.

Total foreign exports of rice from Malaya in August 1933, were 14,717 tons (including 334 tons local production) as compared with 15,861 tons in August 1932.

Of these exports 78 per cent. were consigned to Netherlands India and 22 per cent. to other countries.

Net imports for the period January to August 1933, were 281,279 tons as compared with 267,135 tons during the same period for 1932, a rise of 5.3 per cent.

India and Burma.—Total foreign exports of rice during July 1933, were 131,000 tons as compared with 221,000 tons in the previous month and 119,000 tons in July 1932.

Japan.—The position from August 1st, to the end of October, is estimated as follows :—

Supply		Tons	Tons
Stocks on August 1st	... ..	3,110,000	
Imports from Korea	... ..	180,000	
" " Formosa	... ..	199,000	
" " Other Countries	... ..	43,000	3,532,000

Siam.—Exports (approximate) during August 1933, amounted to 142,346 tons as compared with 136,575 tons in August 1932.

The area under padi for season 1932—1933 in 60 Provinces amounted to 8,034,476 acres, an increase of 307,502 acres or 4 per cent. as compared with the same period of 1932.

The area damaged is estimated at 505,964 acres, a decrease of 767,970 acres or 60 per cent. from that of the previous year.

Netherlands India, Java and Madura.—For the period end of July 1933, the area harvested amounted to 7,658,000 acres a decrease of 96,000 acres or 1 per cent. as compared with the corresponding period of 1932: the area damaged was 398,000 acres an increase of 90,000 acres or 29 per cent. as compared with 1932, and additional plantings awaiting harvesting amounted to 1,578,000 acres.

an increase of 271,000 acres or 21 per cent. The total acreage at the end of August 1933, amounted to 9,634,000 acres, an increase of 265,000 acres or 3 per cent. as compared with the same period in 1932.

French Indo-China.—Entries of padi at the port of Cholon from January to August 1933, amounted to 851,523 metric tons, an increase of 41,843 tons or 5 per cent. as compared with the same period of 1932.

Exports of rice from Saigon for the period January to August 1933 totalled 954,540 tons, an increase of 129,904 tons or 16 per cent. as compared with the corresponding period of 1932.

Ceylon.—Imports for the period January to July 1933, totalled 253,370 tons, a decrease of 12,309 tons on the imports for the same period of 1932.

Of these imports 20 per cent. were from British India, 80 per cent. from other countries.

Europe and America.—Quantities of rice shipped from the East were :—

- (a) To Europe for the period January 1st to August 24th, 933,962 tons, an increase of 237,655 tons or 34 per cent. as compared with the same period of 1932. Of these shipments 52 per cent. were from Burma, 3 per cent. from Japan, 38 per cent. from Saigon, 6 per cent. from Siam and 1 per cent. from Bengal, as compared with 57 per cent. from Burma, Nil per cent. from Japan, 36 per cent. from Saigon, 4 per cent. from Siam and 3 per cent. from Bengal in 1932.
 - (b) To the Levant, period January 1st to August 3rd, 20,722 tons, a fall of 21,753 tons or 51 per cent. as compared with the same period of 1932.
 - (c) To America and the West Indies for the period January 1st to August 3rd, 99,765 tons an increase of 10,416 tons or 12 per cent. as compared with the same period of 1932.
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MALAYA RUBBER STATISTICS

ACREAGES OF TAPPALE RUBBER NOT TAPPED ON ESTATES OF 100 ACRES AND OVER, FOR THE MONTH ENDING AUGUST, 1933.

STATE OR TERRITORY	Acreage of Tappable Rubber end 1932	ESTATES WHICH HAVE ENTIRELY CEASED TAPPING		ESTATES WHICH HAVE PARTLY CEASED TAPPING		Total (3) + (5)	Percentage of (7) to (2)
		Acreage (3)	Percentage of (3) to (2) (4)	Acreage (5)	Percentage of (5) to (2) (6)		
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
STRAITS SETTLEMENTS :—							
Province Wellesley	44,734	1,447	3.2	8,028	17.9	9,475	21.1
Dindings	6,969	209	3.0	857	12.3	1,066	15.3
Malacca	111,780	5,315	4.7	20,325	18.2	25,640	22.9
Penang Island	1,635	626	38.3	255	15.6	881	53.9
Singapore Island	28,269	10,560	37.3	4,523	16.0	15,083	53.3
Total S.S.	193,387	18,157	9.4	33,988	17.6	52,145	27.0
FEDERATED MALAY STATES :—							
Perak	250,951	8,024	3.2	34,602	13.8	42,626	17.0
Selangor	308,379	9,566	3.1	42,422	13.7	51,988	16.8
Negri Sembilan	228,541	8,783	3.8	22,210	9.7	30,993	13.5
Pahang	38,141	6,145	16.1	5,339	14.0	11,484	30.1
Total F.M.S.	826,012	32,518	3.9	104,573	12.7	137,091	16.6
UNFEDERATED MALAY STATES :—							
Johore	325,747	28,383	8.7	36,075	11.1	64,458	19.8
Kedah (a)	114,551	5,254	4.6	8,984	7.8	14,238	12.4
Kelantan	21,175	6,715	31.7	2,591	12.2	9,306	43.0
Trengganu (b)	4,352	Nil	Nil	2,072	47.6	2,072	47.6
Perlis (a)	957	177	18.5	542	56.6	719	75.1
Total U.M.S.	466,782	40,529	8.7	50,264	10.8	90,793	19.5
TOTAL MALAYA	1,486,181	91,204	6.1	188,825	12.7	280,029	18.8

Notes :— (a) Registered companies only and are rendered quarterly.

(b) Registered companies only.

The above table together with a Summary, was prepared and published by the Statistics Department, S.S. and F.M.S. in September 1933.

MALAYAN AGRICULTURAL EXPORTS, AUGUST 1933.

PRODUCT.	NET EXPORT IN TONS.				
	Year 1932	Jan-Aug. 1932	Jan-Aug. 1933	August 1932	August 1933
Arecanuts ...	20,280	13,615	13,513	481	1,592
Coconuts, fresh† ...	108,123	83,244	68,066	8,972	8,530
Coconut Oil ...	11,932	7,322	11,759	1,225	1,252
Copra ...	97,464	55,185	60,545	12,469	13,919
Gambier, all kinds ...	2,925	2,103	1,637	330	276
Palm kernels ...	1,248	752	1,148	161	186
Palm oil ...	7,892	4,547	6,130	734	1,207
Pineapples canned ...	66,291	50,729	46,845	5,723	6,487
Rubber § ...	417,137	272,085	292,476	36,408	41,074
Sago,—flour ...	10,267	5,226	2,850	1,087	467*
„ —pearl ...	3,128	1,888	1,430	487	210
„ —raw ...	4,148*	2,696*	2,649*	264*	219*
Tapioca,—flake ...	9,028	6,325	7,239	1,049	570
„ —flour ...	392	190*	126*	69	2
„ —pearl ...	19,977	13,912	11,608	2,010	2,097
Tuba root ...	165½	83	313½	20	43

† hundred in number.

§ production.

* net imports.

MALAYAN PRODUCTION IN TONS OF PALM OIL & KERNELS
FIRST AND SECOND QUARTERS, 1933.

(As declared by Estates).

			Palm Oil		Palm Kernels	
			F.M.S.	Johore	F.M.S.	Johore
1933 January ...	...	...	502.0	129.0	94.6	20.4
February ...	...	...	550.4	155.6	112.5	27.0
March ...	...	...	756.5	208.4	130.6	33.2
Total 1st Quarter ...	...	...	1,808.9	493.0	337.7	80.6
1933 April ...	...	...	689.7	261.2	110.2	48.6
May ...	...	...	492.0	365.9	94.9	26.9
June ...	...	...	547.8	500.6	91.9	98.5
Total 2nd Quarter ...	...	...	1,729.5	1,127.7	297.0	174.0
Total 1st and 2nd Quarters ...	...	...	3,538.4	1,620.7	634.7	254.6

MALAYA RUBBER STATISTICS
TABLE I
STOCKS, PRODUCTION, IMPORTS AND EXPORTS OF RUBBER, INCLUDING LATEX, CONCENTRATED LATEX AND REVERTEX,
FOR THE MONTH OF AUGUST, 1933 IN DRY TONS.

Territory	Stocks at beginning of month 1			Production by Estates of less than 100 acres and over			Imports			Exports including re-exports			Stocks at end of month		
	Estates of 100 acres and over			during the month			during the month			during the month			January to August 1933		
	Ports	Dealers	Estates of 100 acres and over	January to August 1933	August 1933	January to August 1933	Foreign	From Malay States	From Layan	Foreign	Local	Foreign	January to August 1933	Dealers	Estates of 100 acres and over
MALAY STATES :-															
Federated Malay States	11,669	11,927	88,497	10,111	Nil	Nil	Nil	16,409	4,371	112,187	48,962	...	11,744
Johore	...	12,103	2,937	3,046	28,562	4,461	Nil	76	Nil	1,884	6,258	10,467	52,447	...	3,036
Kedah	...	413	1,891	2,757	18,360	1,511	Nil	Nil	Nil	1,506	2,625	9,703	20,063	...	4,077
Perlis	14	...	...	39	Nil	Nil	Nil	Nil	27	Nil	165	...	15
Kelantan	501	180	940	1,379	Nil	Nil	Nil	83	855	599	5,081	...	331
Trengganu	55	50	147	1,004	Nil	Nil	Nil	Nil	221	Nil	1,605	...	199
Total Malay States	...	16,085	16,738	19,024	137,861	16,825	Nil	76	330	19,882	14,387	133,956	138,223	...	50
STRAITS SETTLEMENTS :-															
Malacca	...	3,850	1,183	1,449	10,987	...	Nil	10	Nil	3,906	...	32,218	...	...	1,270
Province Wellesley	...	1,658	783	593	4,078	...	Nil	Nil	Nil	...	...	...	...	...	728
Dindings	...	31	124	110	773	2,593	Nil	14,381	5,133	6,926	...	50,513	...	1,167	28
Penang	...	1,147	4,948	8	11	30	991	...	...	...	...	...	...	1,362	138
Singapore	...	11,439	30,136	149	169	1,200	12,260	14,381	68,359	31,722	...	134,938	...	5,521	12
Total Straits Settlements	...	19,586	40,593	2,197	2,833	17,068	13,260	14,381	73,502	31,722	...	217,669	...	8,253	145
TOTAL MALAYA	...	12,586	56,678	18,935	21,356	154,925	13,260	14,457	73,832	52,436	14,387	330,625	138,223	9,615	19,410

TABLE IV
DOMESTIC EXPORTS 4

Class of Rubber	20	PORTS		AREA		January to Aug. inc. 1933
		Singapore	Penang	Port Swettenham	Malacca	
DRY RUBBER	9,867	25,131	4,978	4,256	1,510	33,981
WET RUBBER	3,403	6,321	543	216	1,701	11,538
TOTAL	13,270	31,502	5,521	4,472	3,211	45,519

TABLE III
FOREIGN EXPORTS

Class of Rubber	20	Prov. We'lls M. S. S.		Kedah		January to Aug. inc. 1933
		Singapore	Penang	Port Swettenham	Malacca	
DRY RUBBER	9,867	25,131	4,978	4,256	1,510	33,981
WET RUBBER	3,403	6,321	543	216	1,701	11,538
TOTAL	13,270	31,502	5,521	4,472	3,211	45,519

Notes :- 1. Stocks on estates of less than 100 acres and stocks in transit on rail, road or local steamer are not ascertained.
 2. The production of estates of less than 100 acres is estimated from the formula : Production + Imports + Stocks at beginning of month = Consumption during the month - [2] - [3] - [4] - [5] - [6] - [7] - [8] - [9] - [10]. For the Straits Settlements, Columns [9] and [10] represent purchases by dealers from local estates of less than 100 acres, reduced by 15 to terms of dry rubber.
 3. Dealers' stocks of rubber are reduced to dry weights by the following fixed ratios: unsmoked sheet, 15%; wet sheet, 25%.
 4. Domestic exports are estimated by deducting the average monthly dry weight of foreign production from the gross foreign exports of the later month, the foreign exports of the Malay State, being domestic production.
 5. The above, with certain omissions, is the Report published by the Registrar-General of Statistics, S.S. and F.M.S., at Singapore on 24th August 1933.

METEOROLOGICAL SUMMARY, MALAYA, AUGUST, 1933.

Locality	AIR TEMPERATURE IN DEGREES FAHRENHEIT				EARTH TEMPERATURE		RAINFALL						BRIGHT SUNSHINE							
	Means of		Mean of A and B	Absolute Extremes		At 1 foot	At 4 feet	Total	Most in a day	Number of days				Total	Daily Mean	Per cent				
	A.	B.		Max.	Min.					Lowest	Max.	High.	Lowest				Max.	High.	Precipitation, 10 in or more	Thunder-storm
	°F	°F	°F	°F	°F	°F	°F	°F	in.	mm.	in.	mm.	in.	mm.	hr.	hr.	%			
Railway Hill, Kuala Lumpur, Selangor	90.2	71.7	80.9	94	70	86	74	83.9	84.7	7.70	195.6	1.76	17	16	8	6	—	209.15	6.75	55
Bukit Jeram, Selangor	88.3	72.3	80.3	92	70	85	75	84.2	86.0	3.89	98.8	1.08	16	11	3	—	1	232.20	7.49	61
Sitiawan, Perak	89.5	72.3	80.9	94	69	87	75	83.9	85.4	3.01	76.5	0.59	18	16	2	—	—	224.15	7.23	59
Kroh, Perak *	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Temerloh, Pahang	90.2	72.1	81.1	94	69	86	74	85.1	86.4	6.94	176.3	2.09	14	12	—	3	—	225.70	7.28	60
Kuala Lipis, Pahang	88.5	71.6	80.0	91	69	85	75	84.6	85.1	4.59	116.6	1.36	16	14	19	—	—	199.05	6.42	53
Kuala Pahang, Pahang	86.6	74.2	80.4	89	71	81	78	86.3	86.1	4.71	119.6	1.82	15	12	—	—	1	253.10	8.16	67
Mount Faber, Singapore	88.0	75.5	81.7	93	71	77	79	83.5	84.0	5.92	150.4	1.05	14	11	5	—	—	215.10	6.94	57
Butterworth, Province Wellesley	88.1	73.8	80.9	90	71	85	77	84.9	85.6	7.06	142.2	1.66	14	12	1	—	—	230.65	7.44	60
Bukit China, Malacca	85.0	73.8	79.4	87	71	82	77	83.8	84.4	7.30	185.4	2.59	16	13	2	—	—	241.45	7.79	64
Kluang, Johore	87.6	70.9	79.3	91	67	84	74	81.3	82.2	11.00	279.4	3.98	22	17	2	12	—	197.55	6.37	52
Bukit Lalang, Mersing, Johore	86.8	71.9	79.3	89	69	83	75	81.7	82.0	9.58	243.3	3.78	13	11	2	1	1	245.95	7.93	65
Alor Star, Kedah	87.9	74.3	81.1	91	71	84	77	86.0	86.1	7.21	183.1	1.21	17	16	10	1	—	219.60	7.08	58
Kota Bharu, Kelantan	89.7	73.8	81.7	93	72	87	76	85.0	85.4	4.18	106.2	1.24	11	8	1	—	—	238.75	7.70	63
Kuala Trengganu, Trengganu	88.5	73.0	80.7	91	70	82	76	83.9	84.8	1.20	30.5	0.39	8	5	2	—	—	235.40	7.59	62
HILL STATIONS.																				
Fraser's Hill, Pahang 4268 ft.	74.6	62.8	68.7	80	61	71	65	71.2	71.8	8.95	227.3	1.52	21	18	1	5	—	184.35	5.95	49
Pahang Highlands, Tanah Cameron	71.9	55.1	63.5	75	49	68	61	69.2	69.4	10.95	278.1	1.78	20	18	3	1	1	143.85	4.64	38
Rata, Pahang 4750 ft.	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Cameron Highlands, Rhododendron Hill, Pahang 5120 ft.	71.1	59.4	65.3	75	58	66	62	—	—	12.21	310.1	1.75	20	18	1	1	—	146.25	4.72	38

Compiled from Returns supplied by the Meteorological Branch, Malaya.

* This Station has been dismantled.

THE Malayan Agricultural Journal.

NOVEMBER, 1933.

EDITORIAL.

The Malayan Coconut Industry.

The coconut industry is at the present time of very great importance in Malaya, as with the rubber industry in a depressed state the need for other valuable exports is obvious, while the value to the Malay raiat of a money producing commodity, such as copra, is unquestionable.

Two articles dealing with the coconut industry are included in the present number of this Journal. The first article by Dr. H. A. Tempany, C.B.E., gives a review of the industry as a whole in the year 1932, and the second article by F. C. Cooke and H. J. Simpson describes the progress in Malaya of the efforts which have been made to improve the quality of copra produced by small-holders.

Copra is bought and sold on a standard established, for each country of origin, by the average quality of copra received from that country. On the majority of the large estates in Malaya the copra produced is of good quality, but there is need for very considerable improvement in the quality of copra produced by the small-holders, since the admixture of such copra in the exported product lowers the average quality.

The Department of Agriculture has paid considerable attention to the question of an all round improvement of copra, particularly that produced by small-holders, and the results to date are encouraging.

It is not improbable that, since much of the copra produced in Ceylon is now being absorbed by the Indian market, Malayan copra may tend to replace Ceylon copra on the World's markets, particularly if the standard of the exported product can be improved. In this connection it may be mentioned that the copra exported from Malaya is not all produced in this country; a considerable quantity, particularly of low-grade copra, is annually imported for re-export from other countries.

Copra exported from Malaya is graded by the exporters as F.M. (Fair Merchantable), the better quality, being graded as F.M.S. (Fair Merchantable Sundried). The poor quality copra imported into Malaya increases the quantity of inferior grade copra exported, and it is therefore desirable that the local efforts aiming at improvement should be maintained in order to raise the average quality of the copra exported as Malayan produce.

The success of the initial experiments, conducted by the Department of Agriculture in the Kuala Selangor District with the object of stimulating interest in the kiln curing of copra by Malay small-holders, has already had a marked influence, on the standard of copra produced in the coastal district of Selangor. Furthermore, the financial results to the small-holders concerned have been highly satisfactory.

Copra manufacture by small-holders is not confined to Selangor but is becoming an increasingly popular practice in other coconut areas in the Peninsula. There is a tendency, however, on the part of the producers to be content with the enhanced prices offered for copra of poor quality as compared with the price received for nuts, and until the marketing side of the industry can be better organised so that good quality copra produced by small-holders in all the districts will obtain a premium over poor copra, progress towards the ideal of raising the average quality of Malayan produced copra will be delayed. It is felt that in order to establish copra manufacture amongst Malay small-holders on a sound basis, the tendency to be content with the manufacture of a low grade product should be discouraged and the producers stimulated to manufacture high grade copra since efforts to organise the marketing of the product are only likely to be fully successful if adequate supplies of good copra are available in the districts where small-holder's copra is produced.

Manurial Treatment of Grass.

While a considerable amount of work has been carried out in other countries on the effect of manuring and frequency of cutting upon the yield, composition and feeding value of grasses, the investigations have been concerned chiefly with natural pastures.

In Malaya, natural pasture is the exception and, in order therefore to provide suitable fodder for feeding stock, pure strains of grasses must be cultivated.

In the article included in the present number entitled "Manurial Experiments with Guinea Grass at Serdang" Messrs. V. R. Greenstreet and J. L. Greig record the preliminary results of an investigation, which it is hoped will have far reaching consequences in effecting an improvement in the general quality of grass used for feeding stock in Malaya.

Although, as will be seen, the figures for yields only cover a period of six months, some interesting conclusions can already be drawn, particularly as regards the correlation between type of soil and interval of cutting.

As pointed out in the text, the present article must be regarded more in the nature of a progress report, different aspects of the question being considered as more details become available. For example, in the next article on the subject it is hoped to discuss the questions of yield and seasonal variation combined with interval of cutting, also that of the feeding value of the grass.

In conclusion, it is pointed out that the results of the investigation should be of special interest to agricultural workers in other tropical countries, in which similar conditions as regards scarcity of natural pasturage exist, since, as far as is known, little attention has been given to the question of the cultivation of pure strains of grasses under controlled conditions.

Agricultural Shows. Perhaps one of the most striking changes that has occurred during the past two years in Malaya is that in the attitude adopted towards agricultural shows, particularly small district shows.

These functions have for many years past enjoyed a certain popularity in this country and have usually been organised on more or less definite lines; the Kuala Lumpur Exhibition annually held by the Malayan Agri-Horticultural Association with the collaboration of the Department of Agriculture has been regarded as a central event of the year in this respect, while small shows in the district occupied the position of ancillary and supplementary events. The popular attitude towards shows was in general to regard them as being in a certain degree beneficial, but as more particularly possessing importance as social events which helped to bring people together from distant points, tended to induce good-will and generally brightened up the somewhat dull and monotonous existence of the inhabitants of the countryside.

Viewed from this angle it is not altogether surprising that, when the financial depression first made itself felt, the general reaction on the subject of agricultural shows was, in the first instance, to regard them as being more or less in the nature of luxuries which it was necessary to dispense with until better times supervened.

As an index of this feeling it may be pointed out that in 1931 the Kuala Lumpur Exhibition was the only one held in the country; considerable opposition to the holding of this show was exhibited and it only took place because the Malayan Agri-Horticultural Association and the Department of Agriculture strongly held the opposite view, *viz.* :—that shows were entitled to be regarded as possessing far more importance than a considerable section of the public was inclined to accord them.

Since that year a very considerable change in the popular attitude has taken place. It has now come to be regarded as a somewhat trite commonplace to stress the importance of broadening the basis of Malayan agriculture and particularly the agriculture of the small-holder; but, be this as it may, there is no question of its truth and the measures that can be adopted to secure this end are of importance.

It is obviously essential that efforts directed to this end should be correlated and organised along defined channels and it has to be remembered that the broadening process must take place in at least three directions *viz.* :—

- (1) The increasing of the number of crops grown and the crop products turned out in commercial quantities;
- (2) The increasing of the area under products other than rubber;
- (3) Possibly the most important of all,—the raising of the general level of quality of Malayan produce other than rubber.

At the present time a definite policy tending to bring about improvement in all three directions is being pursued; it comprises a large number of lines and as part of this programme agricultural shows definitely hold an important place. It must be realised that, if one leaves on one side rubber and palm oil, there is hardly a product that is produced in Malaya which is capable of competing on terms of equality with the best class of produce on the market. It is, therefore, as part of the plan for enlarging the range and improving the quality of the agricultural produce of small-holders that shows have their particular interest and value. To cite a few examples Malayan small-holders' copra, rice, tapioca, coffee and arecanuts all fall in quality far below the highest standards demanded by the market and it is essential that if progress is to be achieved that the quality should be raised. It is obvious, of course, that this can only be achieved by patient and painstaking work in a variety of directions. It necessitates experiments, instruction and demonstrations, the organisation if necessary of markets and the introduction of grading. Efforts are being made along all these lines, but conjoined with them shows and particularly small district shows can and do play a most important and valuable part.

That this is becoming realised is evidenced by consideration of the figures for the number of shows held of late years. As previously pointed out in the year 1931 the only show held in the whole of Malaya was the Kuala Lumpur Exhibition. In 1932 in addition to the Kuala Lumpur Exhibition four district shows were held. In 1933 in addition to the Kuala Lumpur Exhibition eleven district shows were held; this is believed to be a record for the number of district shows that have been held in Malaya in any one year. It is hoped that as time goes by and the real purpose and benefit of shows becomes more and more known the number held annually will continue to extend.

It is pleasing to notice that in places where these efforts have been started definite advances are already visible both in the quality and variety of produce exhibited and in the number of exhibits, but it is important to realise that shows can only exert their full effect if the policy of holding them at regular interval is steadily pursued. Sporadic effort is of comparatively little value. It is also important that so far as possible there should be some form of organisation which can indicate suitable methods to be followed in the organisation of shows and provide standards for judging produce and help so far as possible to keep

shows on sound lines. The work of the Malayan Agri-Horticultural Association coupled with that of the Department of Agriculture in this direction is already beginning to show signs that it is exerting an appreciable influence; if guidance is not forthcoming mistakes frequently occur which could readily be avoided if full information was available.

An interesting additional possibility in connection with shows is that of using them as centres for crop competitions and making the district shows serve as feeders for All-Malayan Competitions to be held as a culminating point in connection with the Central Exhibition in Kuala Lumpur. A scheme for an All-Malayan Rice or Padi Competition organised on these lines is at present under consideration by the Malayan Agri-Horticultural Association working in collaboration with the Agricultural Department and the various administrations. We shall hope to discuss this matter further in a subsequent issue of this Journal.

Original Articles.

COCONUTS & COPRA IN MALAYA IN 1932.

BY

H. A. TEMPANY,

Director of Agriculture.

During 1932 market conditions for coconut oil and coconut products continued to be adversely affected by the economic conditions which prevailed, although prices were maintained at a somewhat higher level than in 1931.

Coconut Products.

Prices. The Singapore price of 'sundried' copra remained constant throughout the year at between \$5 and \$6, with the exception of the period from the middle of February to the middle of March, when the price rose to \$7 a picul for a short time.

The average price of 'Sundried' for the year was \$5.74 per picul as compared with \$5.09 in 1931. 'Mixed' averaged \$5.22 per picul in 1932 as compared with \$4.64 in the previous year.

TABLE I.

Average Monthly Prices of Malayan Sundried Copra during 1932. *

1932	London Per ton			Singapore Per picul (133½ lbs.) \$
	£	s	d	
January ...	15	5	0	5.73
February ...	15	4	6	6.26
March ...	16	14	4	6.17
April ...	16	16	8	5.67
May ...	15	0	0	5.48
June ...	14	16	10	5.17
July ...	13	10	0	5.40
August ...	13	18	4	5.55
September ...	14	11	3	5.76
October ...	14	16	3	5.75
November ...	14	11	4	5.81
December ...	14	15	0	5.72
Average for 1932 ...	15	0	6	5.74

* "Tropical Life" Weekly Copra Prices.

While prices improved in 1932 over the very low prices of the previous year, it must be remembered that the 1932 prices are much below those of previous years—'Sundried' in 1930 averaged \$7.88, in 1929 \$9.65 per picul, while the average annual price per picul for the years 1922—1928 was \$11.26.

The average price of coconut oil in 1932 was \$13 per picul as compared with \$9.69 per picul in 1931.

'Poonac', or coconut oil cake, averaged \$2.10 per picul in 1932 as compared with \$1.82 per picul in 1931.

World Production.*

An estimate of the world production of copra based on the figures for the total acreage under coconuts in the World, which in 1930 amounted to about 7¼ million acres, and the assumption that 2½ acres of palms yield 1 ton of copra shows that about 3 million tons of copra are now produced annually. It is estimated that over 40 per cent. of the total production is consumed in the countries of origin.

World Exports.

Although Netherlands India is by far the largest exporter of copra, when exports of copra and coconut oil are combined, the greatest share of the world supply of both commodities entering international trade is that of the Philippine Islands which was 29.3 per cent. in 1930 as compared with 28.6 per cent. from Netherlands India in the same year.

The next most important are those of the British South Sea Islands, Ceylon and Malaya which supplied 11.6, 11.1 and 8.7 per cent. respectively.

Areas in Malaya.

A close census of coconut areas was made in 1930. No further census has been deemed necessary in subsequent years. The following figures (Table ii) are based on the 1930 census, with amendments to include definite new areas opened since that year.

Production in Malaya.

No organisation exists for estimating the total quantity of copra produced in Malaya. Imports from Netherlands India are considerable and are used both in the production in Malaya of coconut oil and for grading with the produce of Malaya for re-export.

* "Survey of Oil Seeds and Vegetable Oil", Vol. II, Empire Marketing Board Handbook No. 61.

TABLE II.
AREA PLANTED WITH COCONUTS IN MALAYA 1932.

	STATE OR TERRITORY.	IMMATURE.			MATURE.			Total (Acres).
		ON HOLDINGS OF		Total Immature area (Acres).	ON HOLDINGS OF		Total Mature area (Acres).	
		Over 100 acres each.	Under 100 acres each.		Over 100 acres each.	Under 100 acres each.		
<i>Federated Malay States.</i>	Perak	11,476	14,196	25,672	37,664	45,604	83,268	108,940
	Selangor	5,398	35,809	41,207	32,429	36,948	69,377	110,584
	Negri Sembilan	155	1,121	1,276	914	3,776	4,690	5,966
	Pahang	256	3,948	4,204	2,456	7,870	10,326	14,530
	Total F.M.S.	17,285	55,074	72,359	73,463	94,198	167,661	240,020
<i>Straits Settlements.</i>	Singapore	...	400	400	3,159	4,841	8,000	8,400
	Malacca	...	2,330	2,330	...	10,255	10,255	12,585
	Dindings	893	1,696	2,589	1,764	2,177	3,941	6,530
	Province Wellesley	2,183	1,438	3,621	15,415	17,785	33,200	36,821
	Penang	308	359	667	2,936	9,923	12,859	13,526
	Labuan	...	1,958	1,958	...	1,238	1,238	3,196
	Brunei	...	681	681	...	689	689	1,370
	Christmas Island	...	...	...	...	19	19	19
	Total S.S.	3,384	8,862	12,246	23,274	46,927	70,201	82,447
<i>Unfederated Malay States.</i>	Johore	428	32,622	33,050	2,873	129,127	132,000	165,050
	Kedah	361	8,725	9,086	492	17,382	17,874	26,960
	Perlis	...	1,434	1,434	...	2,527	2,527	3,961
	Kelantan	...	...	...	...	...	...	57,271
	Trengganu	...	...	...	...	...	...	25,000
	Total U.M.S.	...	...	...	...	...	...	278,242
Grand Total	Malaya	...	...	...	...	...	...	600,709

It is probable that local consumption of coconut oil, mainly for culinary purposes, is considerable, so that the nut equivalent of net exports is the most satisfactory measure for gauging the progress of the industry. The comparative figures in this respect for the past 5 years are shown in Table III.

TABLE III.

Nut-equivalent * of Net Exports from Malaya of Coconut Products.

Year	Coconut Fresh	Copra	Coconut Oil	Total
	Thousands of Nuts			
1928	18,871	478,140	80,307	577,318
1929	15,735	562,145	70,890	648,770
1930	14,669	510,070	76,969	601,708
1931	14,715	502,840	80,665	598,220
1932	10,812	487,320	96,947	595,079

The net exports of products in 1932 and a comparison with the two previous years are given in Table IV.

In addition, the net exports from Malaya in 1932 of oil cakes (mainly coconut oil cake), amounted to 2,772 tons, valued at \$84,777 as compared with 906 tons, value at \$12,660 in 1931.

* Equivalents : 1 ton oil = 8,125 nuts.
 1 ton copra = 5,000 nuts.
 1 ton nuts = 1,400 nuts.

TABLE IV.

Net Exports of Coconut Products from Malaya.

	Fresh Coconuts		Copra		Coconut Oil		Total Value Net Exports
	Tons	\$	Tons	\$	Tons	\$	\$
1930	10,478	406,921	102,014	15,307,511	9,472	2,359,357	18,073,789
1931	10,511	245,314	100,563	9,662,785	9,928	1,642,250	11,550,349
1932	7,723*	313,346	97,464	10,766,633	11,932	1,982,245	13,062,224

* Nuts exports were 10,812,300 nuts, equal to 7,723 tons on basis of 1,400 nuts per ton.

The value of the exports of coconut products shows some improvement over that of the previous year, but is less than the annual average of the years 1923—30 inclusive by no less than \$8,730,546 or 40 per cent. below this average.

Trade.

The trade in coconut products was well maintained in 1932. The gross imports and values are as stated in Table V.

TABLE V.

Gross Imports into Malaya of Coconut Products.

	Fresh Coconuts		Copra		Coconut Oil		Total Value Imports
	Tons	\$	Tons	\$	Tons	\$	\$
1930	308	6,244	89,689	10,935,053	30	6,231	10,947,528
1931	1,727	28,105	87,268	6,745,576	250	40,215	6,813,896
1932	1,889	50,797	99,934	8,380,131	455	75,561	8,507,489

It follows that only about 50 per cent. of the copra exports of Malaya is the produce of this country, practically the entire remainder originating from Netherlands India.

A feature of the trade in coconut products in recent years, and particularly in the year under review, is the steady increase in the local production and export of coconut oil. The net exports in 1932, *viz.* 11,932 tons, constitutes a record. The average annual net exports for the years 1923—31 inclusive was 8,508 tons. The percentage share of coconut oil in the aggregate world exports was 19.8 in 1926, 23.6 in 1927, 22.3 in 1928, 26.4 in 1929 and 23.2 in 1930.

The copra exports from individual States in Malaya for the year 1932 are not at present available. The exports of copra from the Federated Malay States in 1932 were 74,085 tons, as compared with 65,583 tons in 1931. The principal producers were Perak with exports of 46,806 tons in 1932 as compared with 41,259 tons in 1931 and Selangor with 26,655 tons exports in 1932 and 23,683 tons in 1931.

It may be inferred therefore that the increase in net exports of coconut oil of 2,000 tons is accountable chiefly to the more extended use of copra from the Unfederated Malay States and Straits Settlements for this purpose.

It may be of interest to allude here to a misconception regarding the question of improvement of Malayan copra which has apparently gained rather widespread acceptance.

Malayan copra comes on to the markets of the world in two grades, *viz.* F.M.S., *i.e.* Fair Merchantable Sundried and F.M., Fair Merchantable.

The view appears to exist among a certain section of the trade in London that efforts to improve Malayan copra should be directed to the improvement of the lower rather than the higher grade. This is due to a misunderstanding of the position, inasmuch as these two grades represent not the grades of copra as produced on estates and small holdings, but export grades which are artificially created at the point of shipment by the exporters themselves.

Copra coming from estates and from small producers is delivered to the buyers' godowns at the ports as two grades, *viz.* sundried and mixed. At the ports it is regraded by the exporters; it may be said that practically all the sundried copra goes forward as F.M.S., but the mixed copra is divided between the two the better quality pieces being graded as F.M.S., and the rejects as F.M.

It is further to be borne in mind that, as has been already shown, copra exported from Malaya is by no means entirely produced in the country, quite a considerable proportion, especially of the lower quality, is imported from Netherlands India, regraded at the ports and re-exported and this goes to swell the exports of F.M. copra which comes on to the markets as Malayan produce but in reality is only partially so.

In these circumstances it will be understood that the suggestions which have been made that attention should be focussed on the production of improved quality F.M. copra are beside the point; because the result of such efforts will be that any improvement in quality effected will entail that instead of being graded as F.M. copra, improved produce will be graded as F.M.S. by the exporters.

It is as well that this point should be clearly grasped as apparently the true significance of the position is not fully appreciated outside Malaya.

Conditions on Estates.

Increased attention has been paid to a number of points in relation to the coconut industry on estates.

The practice of clean weeding is showing signs of being superseded by a system of cover cropping on a number of estates, while others are adopting a system of periodical slashing of undergrowth; in certain instances, the adoption of these methods has been followed by marked improvement both in appearance of palms and in their yields.

Coconuts in Malaya are for the most part grown on heavy clay soils thereby markedly differing from the conditions under which they are cultivated in the majority of coconut producing countries.

In these circumstances drainage problems are of considerable importance and, as most of the coconut lands are low lying and not infrequently decidedly acid, the question of providing adequate drainage often presents difficulty.

Moreover the question of water movement is of importance under these conditions. It is well known that, in order to secure the best results, coconuts should be planted under conditions in which there is a slow but steady movement of subsoil water. To secure this end certain estates have adopted a system of alternately filling and emptying drains at regular intervals thereby promoting movement of soil water and helping to lower acidity by flushing out the soil.

The cultivation of dwarf coconuts presents a special series of problems in this respect; fair areas of palms of this type are established on certain estates; of the three varieties the green dwarfs have been shown to give the best results but even with these, results are very variable. Evidence accumulated during the year appears to indicate that drainage questions have a good deal to do with the problem, and that dwarf coconuts may require a perceptibly higher water table than do the tall palms.

As a general rule coconuts in Malaya are not manured, but during the year increasing attention has been given to this question and a series of experiments has been carried out on estates in conjunction with the Department of Agriculture to test the point. So far the results have been largely negative save that in one instance cultivation combined with green manuring has given rise to significant increase in yield.

Investigations in this direction are being continued.

During the year an investigation concerning the amount of plant food material removed annually in the process of cropping and in the fallen leaves and inflorescences was completed. The results indicate that these losses are considerable amounting in total on the average of Malayan conditions to

Nitrogen	...	67.0 lb. per acre per annum
Phosphoric acid	...	28.0 lb. do.
Potash	...	125.5 lb. do.

The conclusion is reached that losses should be minimised by returning to the soil as large a proportion as possible of the actual constituents, but that even if all possible precautions are taken in the return of leaves, inflorescences, husks and shell, or the ash thereof, the application of artificial fertilisers may still be necessary if mature palms are to continue to yield good crops.

Statistics of yields and of sunshine and rainfall have been collected by the Department of Agriculture over a period of three years for six estates in Lower Perak, with a view to endeavouring to establish correlation between weather conditions and yields of nuts and copra. Although exact correlation is difficult it would appear that rainfall is the chief determining factor.

Heavy rainfall appears to exert its greatest influence on nut size from the second to the seventh month, while sunshine has the greatest effect in improving copra yield per nut, if it occurs from the seventh to the ninth month.

Great interest has been manifested on estates in the possibilities inherent in the improvement of the quality of copra produced.

Investigations have shown that the common faults of Malayan copra, *viz.* discoloration, moulds and insect attack are due in large part to defective drying systems and particularly to overloading of kilns. It has been shown that by careful attention to matters in these respects no difficulty exists in producing copra equal in appearance to the Ceylon No. 1 grade. It has also been found that the kiln which is cheapest and easiest to construct and operate is the Ceylon type of smoke kiln and that, bearing in mind the costs of operation and construction, the more elaborate and expensive types of driers offer few, if any, advantages. Certain modifications in kiln construction have been introduced and tried out on a number of estates and there is a definite trend in consequence towards the production of copra of superior grade.

So far these efforts have been without perceptible effect on the market prices; on the other hand it has been established that greater attention to quality tends to minimise losses in transit to an appreciable extent and hence will repay the labour expended on its performance.

During the year information has been obtained concerning moulds attacking copra under Malayan conditions and a number of moulds have been identified, chief among which are species of *Aspergillus* and these are found to be associated with certain bacteria.

Conditions on Small-Holdings.

Considerable progress has to be recorded in the matter of copra production by small growers as opposed to the long established practice of selling nuts to middlemen, copra makers and dealers.

Following the success of the early efforts in Kuala Selangor district, and in response to propaganda by the Department, development proceeded rapidly until the preparation of their own copra by growers has become an established practice throughout the whole of the coconut areas of the Selangor coast.

This radical change in procedure has resulted in substantially increased local prices for both nuts and copra, so that the grower has obtained considerably increased profits therefrom as set forth in the following table, the prices given being in Straits dollars and cents per picul of copra or equivalent.

TABLE VI.

Period	Nut price expressed as copra equivalent	Average price for Malay produced copra	Average price Singapore mixed	Discount below Singapore	
				On price of Nuts	On copra
	\$	\$	\$	\$	\$
1930: June to December ...	3.00	4.00	6.35	3.35	2.35
1931: Whole Year ...	2.50	3.50	4.72	2.22	1.22
1932: January to June ...	3.75	4.43	5.15	1.40	.72
1932: June to December ...	4.05	4.52	5.16	1.11	.64

The advance in prices is due not only to increased competition but represents an effort on the part of dealers to arrest the tendency for growers to make their own copra and the position cannot yet be considered stable. Consequently, prices offered are often higher than are justified economically and, furthermore, apply to poorly made copra as well as nuts. In these circumstances low grade copra obtains a higher price than is justified by its quality, and the difference in price between this and the high grade product is much less than is warranted by the difference in quality. The outcome of this unhealthy position is that the betterment in quality of copra has not made such progress as is desirable. Progress in this respect is of considerable importance, as badly made copra is a spoiled product that cannot be turned into a high quality article by further treatment. On the other hand, a large number of recently erected growers' kilns have regularly turned out well prepared copra of estate quality and twelve of the kilns have produced copra equal to the Ceylon standard.

Arrangements have been made for periodic examination of copra prepared on kilns of approved pattern erected by growers, both in Selangor and in other parts of Malaya, so that a regular check is kept upon the quality of the product.

The start made in Selangor has been followed by similar developments in other parts of Malaya. Several of the approved pattern kilns have been erected in Province Wellesley and have produced copra of first grade quality. In the large copra area on the coast of Perak at Bagan Datoh, over 300 kilns have been erected by growers. Only a small proportion of these satisfy the Agricultural Department's standard and most of them are incapable of producing high grade copra owing to faults in construction.

The position in Johore is very similar, there being a large number of kilns only a small proportion of which are capable of producing high grade copra.

Present efforts are therefore directed towards effecting improvements in this respect and a Malay Officer, who has been trained for these special duties, has been detailed to supervise the erection of suitable kilns and to give advice on copra preparation.

Up to the present it has been possible to make arrangements for the sale of such high grade copra as has been produced at a price approximating to its true worth on ruling market prices. In Kuala Selangor district, when the first properly designed kiln began production, the difficulty was met by an arrangement with a local oil mill and the product recently made in Province Wellesley was disposed of to a Penang firm. As the movement develops, however, some definite market organisation will be necessary if the high grade product is to obtain the premium over the low grade article that its quality justifies and unless this premium is obtained there is bound to be a falling off in quality.

This matter is receiving careful attention at the moment.

Another aspect of the problem that has received recent consideration is the question of the registration of each group of growers concerned in the joint ownership and management of a kiln under regulations in a form most suitable to their requirements. It has become evident that some provision is necessary at an early stage in order that the growers concerned can operate and conduct business as a corporate body.

Pests of Coconuts.

Control of the coconut beetle (*Oryctes rhinoceros*) was efficiently maintained in all parts and calls for no special comment.

The caterpillar of the Zygaenid moth, *Artona catoxantha*, caused damage of varying extent to palms in Province Wellesley, in Krian and Kinta districts of Perak, in Selangor and in Singapore. The most serious attack was in Province Wellesley where damage has persisted since June and the pest is still in evidence at the end of the year. In Selangor, approximately 80 acres on an estate sustained damage in April, but the pest quickly disappeared as the results of heavy parasitisation. Elsewhere, attacks were slight and of very minor importance.

MANURIAL EXPERIMENTS WITH GUINEA GRASS AT SERDANG.

BY

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Introductory.

Owing to the scarcity of natural pasture in Malaya, and the consequent necessity for cultivating fodders required for feeding stock, experiments with different grasses have been commenced at the Government Experimental Plantation, Serdang, with the objects of ascertaining both the optimum interval between cutting and the manurial treatment, which will furnish the maximum yield of a grass containing adequate proportions of digestible nutrients and minerals.

Guinea grass, *Panicum maximum*, has been chosen for the first series of experiments, principally because this grass is relished by cattle and is also of good nutrient value. Later, it is hoped to extend the work to Napier grass, *Pennisetum purpureum*, and Dallis grass, *Paspalum dilatatum*.

Although the guinea grass has only been growing for 15 months, and yields are only available over a period of 6 months, it is considered that the results to-date are of sufficient interest to warrant publication.

Apart from the description of the original lay-out of the experiment, the present article must be regarded more in the nature of a progress report, since it is probable that, as a result of the combined effects of seasonal variations, manurial treatments and increasing age of the grass, some of the present conclusions may have to be modified.

Selection of Land.

Although previous trials with guinea grass at Serdang have shown that high yields of grass, 40 tons per acre per annum, can be obtained on freshly-opened jungle land, in the case of the present experiments, care was taken to select land which had previously been cultivated with other crops, thereby ensuring that the effect of a particular manurial treatment would not be masked by a high natural fertility factor.

Two types of soil were chosen for the experiment, a heavy soil in which the sand fractions varied from 14 to 44 per cent., and a light soil, in which the same fractions varied from 40 to 60 per cent.

As regards previous cultivation, the heavy soil had been planted with croton, *Croton Tiglium*, while in the case of the light soil the land was planted originally with limes, *Citrus medica* var. *acida*, but had latterly been allowed to develop into rough grazing.

In the case of the heavy soil, the land selected is on a slight slope, but the light soil area is flat.

Lay-out of Experimental Plots.

Since the experiment is designed to ascertain both the optimum interval between cutting and the most economical manurial treatment it is considered advisable to discuss these two points before describing the arrangement of the individual plots.

As regards the interval between cutting, it was decided in the first instance to commence recording yields after one week, two weeks and three weeks growth respectively. As will be seen later, the weekly system of cutting proved too exhausting for the grass, and a monthly interval was substituted.

The details of the different manurial treatments are given in Table 1.

As will be seen, the treatments were chosen in order to provide a direct comparison between the effects of acidic and basic manures as regards the two types of soil chosen for the experiment.

Further, it will be noticed that for the first year a standard rate of application of phosphoric acid, 120 lbs. per acre, has been maintained throughout the scheme, and no separate application of a nitrogenous manure was included. In view of the long-term nature of the experiment and the low phosphoric acid content of Malayan soils, it was considered preferable for the first year to base the manurial programme on a phosphatic treatment, introducing separate nitrogenous manures at a later date, when the grass had become more established.

In view of the eight manurial treatments and the advisability of replicating each treatment in order to ensure a higher degree of accuracy for the yields, four series of eight plots were laid out in the form of a square, each plot being 1/20 acre. Each plot was trisected along its greater length in order to provide the necessary sub-plots for the different intervals of cutting.

As regards the lay-out of the 1/20 acre plots, the system of controlled randomisation was employed, the final distribution being as shown in Diagram I. A similar arrangement was adopted in the case of both areas.

TABLE I.

Manurial Treatments for Guinea Grass at Serdang.

Serial No.	Details of Manure	Rate of Application lbs. per acre per annum*
1	Basic Slag	750 (120 lbs. P_2O_5)
2	Superphosphate of Lime	750 (120 lbs. P_2O_5)
3	Calcium Cyanamide Basic Slag	210 (40 lbs. N) 750 (120 lbs. P_2O_5)
4	Ammonium Sulphate Superphosphate of Lime	200 (40 lbs. N) 750 (120 lbs. P_2O_5)
5	Calcium Cyanamide Basic Slag Sulphate of Potash	210 (40 lbs. N) 750 (120 lbs. P_2O_5) 167 (80 lbs. K_2O)
6	Ammonium Sulphate Superphosphate of Lime Sulphate of Potash	200 (40 lbs. N) 750 (120 lbs. P_2O_5) 167 (80 lbs. K_2O)
7	Cattle Manure	(67 lbs. N) 10,000 (120 lbs. P_2O_5) (32 lbs. K_2O)
8	Control	No manure

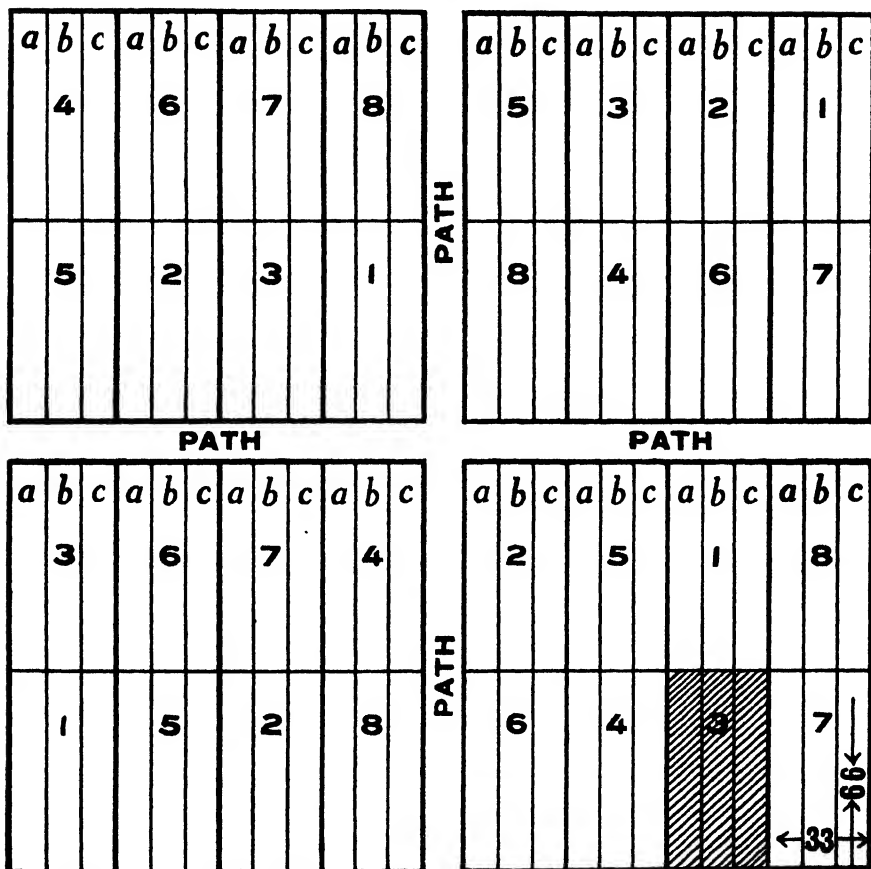
* The approximate amount of Nitrogen (N), Phosphoric acid (P_2O_5) and Potash (K_2O) corresponding to the different amounts of fertilisers are shown in brackets.

Since each variation in cutting and manurial treatment is quadruplicated, it can be calculated that the results are based on yields from areas of 1/15 acre, containing approximately 640 plants.

Planting and Cultivation.

The areas selected were enclosed with wire fencing and ploughed to a depth of 6 inches. Later, the ground was lightly cultivated and levelled in order to obtain an even surface for planting.

DIAGRAM I.
Arrangement of Plots in Manurial Experiments
with Guinea Grass.



- Notes:**
1. The numbers of the plots correspond to the different manurial treatments.
 2. The area of each plot, for example No. 3 shaded, amounts to $1/20$ acre, the area of each sub-plot, for example No. 3a, No. 3b, No. 3c, amounts to $1/60$ acre. The dimensions of each plot, e.g. No. 7, are 66 ft. x 33 ft.
 3. (i) Sub-plots marked "a" were originally cut weekly, later monthly.
 (ii) Sub-plots marked "b" were cut fortnightly.
 (iii) Sub-plots marked "c" were cut three-weekly.
 4. The details of the cutting periods are as follows:—
 First cutting period: December 1932 — January 1933.
 Second cutting period: January 1933 — March 1933.
 Third cutting period: March 1933 — May 1933.

Both areas were planted in March 1932, the stools of grass being spaced at intervals of 2 ft. x 2 ft., square planting.

In order to confine the manurial dressing applied to an individual plot the following precautions were taken :

Heavy Soil. Owing to the land being on a slight slope, silt pits, 1 foot wide and 1 foot deep, were dug along the length of the series of plots, No. 8, No. 1, No. 4 and No. 8, bordering on the upper edge of the main path running through the area. No silt pit was dug, however, on the other side of the path, its place being taken by a guard row. (See Diagram I).

The soil from the silt pits is thrown back periodically on the slope above the row of pits.

Light Soil. In view of the flat nature of the area, silt pits were considered unnecessary, guard rows running lengthwise between each series of plots being substituted in all cases.

The manurial dressings were applied between 4 and 5 months after planting, the cattle manure in July 1932 and the artificial fertilisers in August 1932. The soil was lightly forked, when the manures were applied.

After manuring, the plots received no further treatment beyond periodical weeding.

Cutting and Sampling of Grass.

As explained previously, the 1/20 acre plots were trisected in order to provide three sub-plots corresponding to the three intervals of cutting.

Cutting was commenced in December 1932, and has continued according to the programme as indicated below Diagram I.

As regards the method of cutting, individual stools are cut with a pruning-knife.

The weights of fresh grass for the different replications are recorded and the results summarised for each manurial treatment.

At the expiration of the first six weeks of cutting the total yields for the period were summarised, a similar procedure being followed at the end of a further six weeks.

Since it was found that the weekly system of cutting had proved too exhausting for the grass, a monthly system was substituted, the period of summation for yields being accordingly lengthened to two months.

The procedure for drawing the sample for analysis is as follows: Commencing from one of the four corners of the sub-plot and looking lengthwise along the sub-plot, any stool of grass in the first six of the outside row is selected, the grass being cut and set aside.

The next stool for cutting is found by moving along to the next row and taking the sixth stool farther along the row, counting from the stool adjacent to that which has already been cut.

A similar procedure is followed, until eventually the last stool is taken from the corner diagonally opposite to that in which cutting was commenced.

An example will make the method clear. Assuming that stool No. 3 in the outside row has been selected as the starting-point of the cutting, the succeeding stools will be No. 9 in the second row, No. 15 in the third row, No. 21 in the fourth row and so forth.

The bulked samples of grass from the four replications for each of the eight manurial treatments on the two types of soil, 16 samples in all, are despatched without delay to the laboratory for analysis.

Yields of Grass.

Although the yields have been summarised for three individual periods, only average figures for the whole period of cutting to-date will be included in the present paper. It is thought preferable to defer publication of the yields for individual periods, until records covering a wider range of seasonal variations are available.

The figures for the average yields of grass, calculated in pounds per acre per week for the different intervals of cutting, are accordingly shown in Table II.

As explained previously, in the case of the fortnightly and three-weekly intervals the figures are based on the yields for the whole of the 6 months during which records have been taken. The figures for the weekly intervals only cover the first $3\frac{1}{2}$ months of this period, those for the monthly intervals covering the remaining 2 months.

Excluding the figures for the weekly cuts in view of the discontinuance of this interval of cutting on account of the weakening effect on the grass and those for the monthly cuts on account of the comparatively short period during which this system has been followed, it will be noticed that the range of figures for the three-weekly cuts on both types of soil is higher than that for the fortnightly cuts.

Apart from the question of interval between cutting, there are other factors which affect yield. Among these may be mentioned (a) Soil, (b) Rainfall and (c) Manurial treatment. It is proposed therefore to consider briefly each of these factors in regard to the yields obtained to-date.

(a) *Soil*. The results indicate that the yields on the heavy type of soil are consistently greater than those for the light type of soil.

(b) *Rainfall*. So far, except for a short interval during February, the rainfall has been too evenly distributed to enable any definite conclusions to be

TABLE II.

**Average Yields of Guinea Grass at Serdang, December
1932 - May 1933.**

(Results calculated in lbs. of grass per acre per week).

Manurial Treatment		Weekly Cutting		Fortnightly Cutting		Three-Weekly Cutting		Monthly Cutting	
Serial No.	Details	Heavy Soil lbs.	Light Soil lbs.	Heavy Soil lbs.	Light Soil lbs.	Heavy Soil lbs.	Light Soil lbs.	Heavy Soil lbs.	Light Soil lbs.
1	Basic Slag	439	340	752	421	824	477	593	349
2	Superphosphate of Lime	266	329	422	403	535	438	349	371
3	Calcium Cyanamide Basic Slag	477	374	691	445	765	525	578	334
4	Ammonium Sulphate Superphosphate of Lime	398	266	651	379	756	415	496	344
5	Calcium Cyanamide Basic Slag Sulphate of Potash	493	390	758	472	814	533	593	498
6	Ammonium Sulphate Superphosphate of Lime Sulphate of Potash	405	388	723	497	866	572	604	496
7	Cattle Manure	405	310	633	434	706	441	397	320
8	Control	274	219	439	288	532	329	303	229

Note: To convert pounds of grass per acre per week to tons of grass per acre per annum the above figures should be divided by 43, e.g. 439 lbs. per acre per week = 10.2 tons per acre per annum.

drawn regarding the effect of this factor on yield combined with interval of cutting.

The figures covering the short dry spell in February indicate, however, that under such conditions and with heavy soil there is a tendency for the yield of grass, when cut fortnightly, to exceed that cut at three-weekly intervals.

(c) *Manurial Treatment.* The results of the various manurial treatments may be summarised as follows:—

- (i) The maximum yields with both heavy and light soils are obtained as a result of the complete acidic mixture (ammonium sulphate, superphosphate of lime and sulphate of potash). Yields of 866 lbs. and 572 lbs. of grass per acre per week are equivalent to 20.1 tons and 13.3 tons of grass per acre per annum respectively.
- (ii) As far as can be ascertained the application of a complete mixture (nitrogen, phosphoric acid and potash) to the light soil only raises the yield of grass to a figure of the same order as that found for the control plot on the heavy type of soil.
- (iii) The application of all manures, with the exception of superphosphate of lime *per se* on heavy soil, has effected considerable increases of yield compared with the controls.
- (iv) Cattle manure would appear to be less effective than artificial fertilisers.
- (v) The effect on the yield of the addition of basic slag to the heavy soil is most marked.
- (vi) It is difficult to explain the apparent lack of response to nitrogenous fertilisers. It is possible that this may be due to depletion before yields were recorded. This point will be referred to later.

Analytical Procedure.

The analysis of the grass comprised determinations of (a) moisture, (b) crude protein, (c) crude fibre, (d) ash, (e) lime and (f) phosphoric acid.

In view of the low oil content of the fresh grass, 0.4 per cent. or less, and the relative unimportance of the oil as regards composition, it was considered unnecessary to carry out routine analyses in respect of this constituent.

Further, owing to the large number of samples of grass, and the impossibility of carrying out individual analyses, it was decided to confine the work to a determination of the average composition of the grass during each cutting period. Analyses were therefore restricted to the determinations of the above constituents in average samples drawn from the bulk samples of grass collected during a particular cutting period.

The following procedure was therefore adopted. Each bulked sample of grass is weighed on arrival and quartered until approximately 200 grammes remain. This quantity is finely chopped, after which samples are drawn for determinations of (a) moisture, (b) crude protein.

(a) *Moisture*. 50 grammes are dried for 24 hours in an electric oven heated to a temperature of 65°–70°C. The sample is allowed to cool, and the loss in weight recorded. The oven-dried grass is retained until the expiration of the cutting period, being mixed from time to time with the other samples collected from the same plot.

Although with the above method an absolute figure for the moisture content is not obtained, the period of drying is sufficient to ensure an air-dry sample, which will not deteriorate during the period of storage.

Determinations of the moisture content of the air-dry grass on the conclusion of the period of storage showed that the figure approximated to 13 per cent. When weighing samples for analysis therefore an allowance was made on the above basis, for example, in those cases in which 5 grammes of the moisture-free grass were required 5.75 grammes of the air-dry grass were weighed.

As regards the absolute moisture content of the grass, the results of analysis showed that there was no significant difference between the figures for grass cut at intervals of two and three weeks respectively, the average figure approximating to 79 per cent. The latter figure has accordingly been adopted as standard in the present investigation.

(b) *Crude Protein.* 5 grammes of the fresh grass are digested with 25 c.c. concentrated sulphuric acid, also small amounts of potassium sulphate and copper sulphate, until a clear liquid remains. The latter is diluted with water and the solution made up to 250 c.c. An aliquot portion, 50 c.c., is withdrawn and placed in a bottle, to which similar aliquot portions from the corresponding samples of grass for the same manurial treatment for the remainder of the cutting period are added.

As regards the actual determinations of constituents on the bulked samples the following brief account may be of interest.

(a) *Moisture.* Determination as described above.

(b) *Crude Protein.* An aliquot portion of the bulked solution, corresponding to 2 grammes of the fresh grass, is made alkaline with caustic soda and the ammonia distilled into standard acid, the excess of which is determined by titration with standard alkali. The percentage of crude protein is obtained by multiplying the percentage of nitrogen by the factor 6.25.

(c) *Crude Fibre.* 1.15 grammes of the air-dry grass (1 gramme of moisture-free grass) are boiled for half-an-hour with 75 c.c. of 70 per cent. acetic acid, 5 c.c. of concentrated nitric acid and 2 grammes of trichloroacetic acid under a reflux condenser. The liquid is diluted with water and filtered through muslin. The residue is washed with hot water until free from acid, then with small amounts of alcohol and ether, and dried to constant weight in the steam-oven. The residue is ignited and weighed, the loss in weight being calculated as crude fibre.

(d) *Ash.* 5.75 grammes of the air-dry grass (5 grammes of the moisture-free grass) are ignited in an electric muffle at a temperature not exceeding 600°C., until a clean white ash is obtained. The ash is treated with hydrochloric acid and, after removal of the silica, the solution is made up to 100 c.c., aliquot portions being taken for the determination of lime and of phosphoric acid.

(e) *Lime.* Calcium is precipitated as calcium oxalate from the acid solution by the appropriate method. The calcium oxalate is filtered off, treated with dilute sulphuric acid and the oxalic acid titrated with standard potassium permanganate.

(f) *Phosphoric Acid.* The phosphoric acid is precipitated as ammonium phosphomolybdate from the acid solution by the appropriate method. The yellow ammonium phospho-molybdate precipitate is filtered off, treated with an excess of standard potassium hydroxide, and the excess of standard alkali titrated with standard acid.

Composition of Grass.

Although the figures for the average composition of the grass covering three periods of cutting are available it is not proposed to tabulate the results in the present paper. At this early stage of the experiment it is thought sufficient merely to summarise the results of the determinations to-date, deferring publication of the detailed results to a later stage of the work, when records covering a wider range of seasonal variations are available.

It is also proposed to restrict the observations offered to a consideration of the results obtained with the fortnightly and three-weekly cutting periods only, those for the weekly and monthly cutting periods being excluded for the reasons given when discussing the yields.

(a) *Moisture*. The moisture content of the grass calls for little comment, the average figure of the fresh material being approximately 79 per cent. There were no marked differences between the figures for the grass cut at varying intervals.

(b) *Crude Protein*. The results to-date indicate that manurial treatment has little effect, if any, in causing a significant increase in the crude protein content of the grass, whether cultivated on heavy or light soil.

As regards the combined effects of soil and variation in period of cutting the results in the following table, Table III, which show the average figures for the three cutting periods, may be of interest.

TABLE III.
Variations in Crude Protein Content of Guinea Grass.

(Moisture-free basis).

Type of Soil	Fortnightly Cutting			Three-Weekly Cutting		
	First Period per cent.	Second Period per cent.	Third Period per cent.	First Period per cent.	Second Period per cent.	Third Period per cent.
Heavy Soil ...	17.3	15.6	14.4	17.1	14.7	12.7
Light Soil ...	17.9	15.2	13.6	12.9	12.5	12.0

The following general conclusions can be drawn:—

(i) While in the case of the fortnightly cutting on both types of soil, and of the three-weekly cutting on heavy soil, the figures for the crude protein content are originally of the same order, there is a marked decrease with increasing age of grass, especially in the case of the grass on heavy soil cut at three-weekly intervals.

(ii) Although the crude protein content of the grass on light soil cut at three-weekly intervals is originally much lower, there is no correspondingly marked decrease in this respect with increasing age of grass.

(iii) Considering the figures for grass cut at intervals of three weeks (the period which consistently gave the highest yields) the results show that in a period of six months on the heavy soil there is a reduction of over 25 per cent. in the crude protein content of the grass, compared with a reduction of only 8 per cent. in the case of the grass on the light soil taken over the same period.

As regards the relatively low figure for the crude protein content of the grass on light soil cut at three-weekly intervals, it is interesting to note that by increasing the cutting period to one month there is a further decrease in the crude protein content.

This decrease occurs on both types of soil as the figures for the third cutting period, which are given in the following table, Table IV, show.

TABLE IV.
Decrease in Crude Protein Content of Guinea Grass with Increasing
Intervals of Cutting (Third Cutting Period.)
(Moisture-free basis).

Type of Soil	Fortnightly Cutting per cent.	Three-Weekly Cutting per cent.	Monthly Cutting per cent.
Heavy Soil ...	14.4	12.7	11.5
Light Soil ...	13.6	12.0	10.4

(c) *Crude Fibre.* The results of analysis indicate that neither manurial treatment nor interval of cutting has any significant effect on the crude fibre content of the grass.

As regards the type of soil, the results show that grass grown on heavy soil has a slightly lower crude fibre content than that on light soil, as the figures in the following table, Table V, show.

TABLE V.
Variations in Crude Fibre Content of Guinea Grass.

(Moisture-free basis).

Type of Soil	Fortnightly Cutting			Three-Weekly Cutting		
	First Period per cent.	Second Period per cent.	Third Period per cent.	First Period per cent.	Second Period per cent.	Third Period per cent.
Heavy Soil ...	27.2	28.3	26.3	29.6	27.0	28.1
Light Soil ...	30.0	29.1	27.7	30.6	29.3	29.5

(d) *Ash.* As would be expected, the ash contained varying amounts of soil particles, with which the grass had become contaminated, and the figure for the ash content is therefore of little significance.

As regards soil contamination, the results of determinations showed that this was greatest in the case of grass cut at weekly intervals, when the blades of grass were short and therefore close to the ground.

(e) *Lime.* The following table, Table VI, summarises the results as regards the lime content of the grass, in relation to the different manurial treatments and the varying intervals between cutting.

In view of the fact that the increases in the lime content, except in the case of treatment with cattle manure, have been maintained and that the results have shown such a small range of variation for the different treatments throughout the whole of the experiment to-date, only the average figures for the three cutting periods will be given. As regards the cattle manure the results showed that, while there was a slight increase for the first cutting period, the increase was not maintained.

TABLE VI.
Variations in Lime Content of Guinea Grass.

(Moisture-free basis).

Serial No.	Manurial Treatment	Fortnightly Cutting		Three-Weekly Cutting	
		Heavy Soil per cent	Light Soil per cent.	Heavy Soil per cent.	Light Soil per cent.
1	Basic Slag ...	0.68	0.95	0.59	0.94
2	Superphosphate of Lime ...	0.20	0.68	0.17	0.74
3	Calcium Cyanamide Basic Slag ...	0.69	1.07	0.76	1.02
4	Ammonium Sulphate Superphosphate of Lime ...	0.43	0.64	0.45	0.64
5	Calcium Cyanamide Basic Slag Sulphate of Potash ...	0.61	1.00	0.66	0.97
6	Ammonium Sulphate Superphosphate of Lime Sulphate of Potash ...	0.43	0.57	0.45	0.52
7	Cattle Manure ...	0.33	0.29	0.32	0.26
8	Control ...	0.30	0.28	0.29	0.23

The figures in the above table indicate that :

- (i) While the lime contents of the grass on the control plots of both heavy and light soil are of the same order, 0.30 per cent., calculated on a moisture-free basis, the effect of similar manurial treatment is much more marked in the case of the light than the heavy soil.
- (ii) On both types of soil, basic manures produce a greater increase than acidic manures.
- (iii) The addition of superphosphate of lime alone to the heavy soil has a depressing effect.
- (iv) The lime content of the grass is not affected by an increase in the interval of cutting.

(f) *Phosphoric Acid*. The following table, Table VII, summarises the results obtained to-date as regards the phosphoric acid content of the grass in relation to the different manurial treatments and the varying intervals between cutting.

In view of the fact that there was no tendency for the phosphoric acid content of the grass to diminish with increasing age of grass, only the average figures for the three cutting periods will be given.

TABLE VII.
Variations in Phosphoric Acid Content of Guinea Grass.
(Moisture-free basis).

Serial No.	Manurial Treatment	Fortnightly Cutting		Three-Weekly Cutting	
		Heavy Soil per cent	Light Soil per cent.	Heavy Soil per cent.	Light Soil per cent.
1	Basic Slag ...	0.52	0.88	0.44	0.79
2	Superphosphate of Lime ...	0.29	0.85	0.28	0.83
3	Calcium Cyanamide Basic Slag ...	0.50	0.79	0.48	0.73
4	Ammonium Sulphate Superphosphate of Lime ...	0.45	0.79	0.43	0.76
5	Calcium Cyanamide Basic Slag Sulphate of Potash ...	0.50	0.84	0.46	0.75
6	Ammonium Sulphate Superphosphate of Lime Sulphate of Potash ...	0.46	0.75	0.43	0.67
7	Cattle Manure ...	0.42	0.44	0.39	0.42
8	Control ...	0.32	0.37	0.29	0.31

The following conclusions may therefore be drawn :

- (i) While the figures for the phosphoric acid contents of the grass on the control plots are of the same order in both cases, 0.30 per cent., calculated on a moisture-free basis, the effect of similar manurial treatment is much more marked in the case of the light than the heavy soil.
- (ii) All manurial treatments, with the exception of superphosphate of lime on heavy soil and cattle manure on light soil, effected increases of a similar order. The depressing effect of the addition of superphosphate of lime *per se* to the heavy soil is again most noticeable.
- (iii) The figures indicate a tendency for the phosphoric acid content of the grass to diminish with an increase in the interval of cutting.

Remarks and Conclusions.

Although, as stated previously, figures for both yields and composition cover only a period of six months, it is considered that there is sufficient information available to enable certain general conclusions to be drawn. These may be summarised as follows :—

(a) *Yield :*

- (i) The yields of grass on heavy soil are greater than those on light soil.
- (ii) The three-weekly interval of cutting gives the highest yield of grass.
- (iii) All manurial treatments, with the exception of superphosphate of lime *per se* on heavy soil, effected marked increases in yield. Cattle manure was, however, less effective than artificial fertilisers.
- (iv) Combining soil, yield and manurial treatment the figures indicate that the most satisfactory results to-date from an economical point of view have been obtained with grass grown on the heavy soil, manured with basic slag.

(b) *Composition :*

- (i) The grass on light soil responded better to manurial treatment than that on heavy soil, particularly as regards an increase in both the lime and phosphoric acid contents.
- (ii) Similarly to yield, a depressing effect, as regards both lime and phosphoric acid contents, was obtained with superphosphate of lime *per se* on heavy soil.
- (iii) Manurial treatments had little or no effect as regards raising the crude protein content of the grass.
- (iv) With increasing age there was a marked decrease in the crude protein content of the grass on heavy soil, cut at three-weekly intervals.

(c) *Yield and Composition :*

- (i) Joint consideration of yield and composition shows that basic manures are probably superior to acidic manures, while both are definitely superior to cattle manure as applied under the conditions of the experiment.
- (ii) An interesting feature of the results is the apparent lack of response obtained with nitrogenous and potassic manures when applied in conjunction with phosphatic manures.

As regards the lack of response to nitrogenous manures which, as stated previously, may be due to their rapid depletion, arrangements have been made in the second year's programme of manuring to apply the nitrogenous dressing in three equal parts at intervals of four months. It is hoped thereby to obtain some information as regards this question of rate of depletion.

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THE PROGRESS OF COPRA PRODUCTION BY MALAY SMALL HOLDERS IN SELANGOR.

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Agricultural Field Officer, Selangor.

Introduction.

In Volume XX, 1932 of the *Malayan Agricultural Journal* a short account was given of the results of efforts made by various Officers of the Department of Agriculture to improve the lot of the small-holders in the Kuala Selangor district of Selangor and generally to improve the quality of copra produced by such holders.

The methods employed were to encourage Malay owners of coconut holdings to prepare copra from their own nuts rather than to sell nuts to middlemen who prepared the copra; to encourage the use of an improved type of small kiln capable of producing copra of good quality in preference to the inefficient small kilns in common use; and to obtain where possible the direct sale of the copra to exporters in place of its transfer through one or more middlemen.

The first outcome of these efforts was the erection experimentally by two individual Malays of a brick and a clay-walled kiln respectively of a design approved by the Department of Agriculture.

The effect of these efforts as was expected, has had a very marked influence on copra production throughout the coastal districts of Selangor. The financial benefits derived by the owners of the two kilns concerned, especially the brick-walled one, soon became known, and in the space of a few months, enthusiastic Malays in all parts were erecting kilns and manufacturing their own copra. Since that time copra manufacture by the Malays has become an established industry in Selangor and is becoming so in many other parts of Malaya.

Final Results of Scheme I.

The Javanese owner of the brick kiln, proved to be extremely adaptable, and within a very short time mastered the advice given him. The quality of this man's produce steadily improved until he was turning out some of the best quality copra ever produced in Malaya, and equal to that regularly produced by estates in Ceylon. This improved quality, after the first vital difficulties of marketing were overcome, commanded prices equal to those enjoyed by the large

estates. Owing to his system of paying a bonus, the supply of nuts from his contributors steadily increased, and at the end of 1932 he had increased his production to such an extent that his old kiln was too small, and he found it necessary to enlarge it. This was effected by adding another two compartments, making one large kiln divided into four—whereupon he adopted a four-day drying process.

Final Results of Scheme II.

The Malay owner of the clay-walled kiln, although his kiln was of excellent workmanship, failed, owing to lack of business acumen, to produce such a high quality of copra as that from the brick kiln. Since he was unable to command top prices he suffered considerably from competition by the middlemen producers, and has therefore been of little use for propaganda purposes.

Attention was concentrated on a few of the more progressive Malays who had also erected clay walled kilns and who, within a short period, were able to produce the desired quality of copra.

Practical Difficulties Attending Construction of Clay-Walled Kilns.

As previously reported, the use of alluvial clay alone in construction of the kiln walls did not prove to be entirely satisfactory, owing to excessive shrinkage of the clay, resulting in the formation of large cracks. It was found, however, that if the walls were continually rammed and all large cracks filled with a mixture of equal parts of lime and sand, a lasting wall was obtained. A better method is the employment of a mixture composed of about 80 per cent. heavy clay, 10 per cent. sand and 10 per cent. lime, which is puddled together and well rammed to form the walls, and if this is further faced with a mixture of lime and sand, or cement, no cracking occurs and a wall, almost equal in strength to that of bricks, is obtained.

The use of clay mixtures as a building material has, however, not been very popular, owing to the amount of labour involved and it was soon found that those Malays who had capital available preferred to erect brick-walled kilns. Others with less money made their walls of planks, corrugated iron, bricks and clay, tiles and clay or such other materials. Planks and corrugated iron are not to be recommended owing to the danger of fire and the fact that the latter does not retain the heat sufficiently.

Effect of the Experiments.

(a) On Copra Production.

The most outstanding and direct result has been the large increase in the number of kilns owned by small-holders; thus whereas as in February, 1932, it was estimated that there were 120 kilns, all of which were in the Kuala Selangor

district, by March, 1933, there were approximately 403 kilns, distributed as below :—

<i>District</i>		<i>Kilns</i>
Sabak Bernam	... ..	161
Kuala Selangor	... ..	185
Klang	... ..	14
Kuala Langat	... ..	43
		<hr/>
Total	... ..	403
		<hr/>

Out of this total, 18 are of the improved type, 354 semi-improved and the others a vast improvement on the crude primitive kilns.

The copra produced from these kilns owing to inexperience was at first inferior to that produced by the middlemen producers, but as the owners gained practical experience and obtained assistance from the owners of the improved kilns, the quality slowly improved, and is now slightly better than that produced by the middlemen.

The owners of the improved kilns steadily improved the quality of their copra, and at the time of writing twelve of them are regularly producing copra equal to high-grade estate quality and low grade Ceylon, and thirty seven produce copra equal to average estate quality. At the present time small-holders produce approximately 7,750 piculs of copra a month or 30 per cent. of the total monthly crop from Selangor small holdings. Of this 7,750 piculs some 1,000 piculs are equal to or better than average estate quality.

One of the chief reasons for the slow improvement in quality has been the abnormal prices offered for inferior grades of copra.

(b) On Copra Prices.

As soon as the small-holders commenced copra manufacture in earnest, the middlemen producers at once advanced prices for nuts and later for copra, and, as more and more small-holder producers came into the market, the competition increased. This, together with severe competition between the middlemen themselves, has resulted in the payment of uneconomic prices, and the steady growth of a new sphere of activity on the part of the middlemen producers, namely the buying of wet copra from small-holders and re-drying for the dealers. The price paid for this wet copra has been extremely high and in many cases has actually made the production of dry copra less profitable. Coinciding with a rising market, high prices could safely be paid by the middlemen. Naturally under such conditions the majority of the small-holders preferred to sell their product in a half-finished state not realising the danger

of such a practice, and the serious handicap it has on effecting a general improvement in quality. When the market turned, however, the effect of the practice was at once apparent.

Furthermore, the price offered for good quality copra by the local dealers, was always below the true value, owing to the small quantity produced and the necessity of recovering some of their losses on the lower grades. This fact made it necessary to break with the usual marketing channels and to find alternative markets for these high grades.

(c) On Nut Prices.

As with copra prices, nut prices have also soared to limits never before reached. Towards the end of 1932, in certain areas where copra manufacture by small-holders was well advanced in strong middlemen producing areas, the prices paid for nuts was actually above the equivalent price for copra. It is interesting to note, however, that such attempts by middlemen to regain their old trade have generally failed, for, although in some areas many small-holders have abandoned copra production for nut sales, those with improved kilns have carried on and have kept the prices high, whilst others re-commenced copra manufacture as soon as nut prices dropped again. In other areas attempts on the part of the middlemen producers to regain their old trade have completely failed, as the small-holders have refused to sell their nuts.

Table VI in the preceeding article by Dr. H. A. Tempany, on "Coconuts and Copra in Malaya in 1932", shows the increased prices offered for copra and nuts during 1932 as compared with 1930 and 1931. The following Table gives some idea of the financial advantages which have accrued to the small-holders as a result of these experiments.

PERIOD	Average return per acre per annum with a Fixed Singapore price of \$5.00		Additional gross income	
	By nut sales	By copra manufacture	By nut sales	By copra manufacture
	\$	\$	\$	\$
1930: June — December	23	31	—	—
1931: Whole year	26	37	3	6
1932: January — June	36	43	13	12
1932: July — December	39	44	16	13

The above Table is based on the assumption of an average yield of 10 piculs of copra = 2,500 nuts per acre per annum.

It will be noted from the figures given that, as a result of the change over from nut sales to copra manufacture, the income of the small-holders has been approximately doubled since 1930.

In the case of the Javanese mentioned in Scheme I who purchases an equal number of nuts from five neighbours at the current prices, his income has been trebled.

Methods of Marketing.

As has been previously mentioned, the fact that the local small dealers were not prepared to offer the true price for the high-grade copra produced from the improved kilns, made it necessary to find other buyers. The arrangement made by the District Officer, Kuala Selangor with one of the local Kuala Selangor towkays worked very well until competition became keener. As the towkay was forced to purchase a certain amount of low-grade copra to make up his consignments and had to pay high prices for these grades, he naturally was unable to pay top prices for the good grades. In March, 1932, a wealthy Malay seeing an opportunity of helping his own countrymen, set himself up as a buyer and offered a fair price for the produce from the Malay kilns. This buyer, although always offering high prices, often in excess of the true value for wet copra, would not give an adequate price for high-grade, dry copra and hence the Malays producing that quality were no better off.

As soon as a sufficient quantity of dry copra was being produced by small-holders it became possible to arrange sales direct between them and large dealers. The chief difficulty experienced was to obtain the necessary quantity of high grade copra. Bulking of the varied product from small individual producers was found to be undesirable and hence some form of joint manufacture was necessary.

Three methods of mutual assistance have been adopted :—

- (a) Manufacture by an individual owner.
- (b) Manufacture on a joint-owned kiln.
- (c) Co-operative manufacture.

Manufacture by an Individual Owner.

This was the original scheme adopted by the Javanese owner of the brick-kiln in Kuala Selangor. In his case it has been extremely satisfactory as he has ensured loyalty from his nut suppliers by the payment of a bonus but, in other cases, where such bonus has not been given, the loyalty of the contributors has been very uncertain.

This method should only be recommended if the owner has sufficient capital to erect a proper kiln and to pay working expenses for at least a month. It is also essential that the owner should have business ability and initiative. Furthermore, the owner himself should have a sufficiently large holding to justify the erection of a kiln as full reliance on outside nut supplies is very undesirable.

Manufacture on Joint-Owned Kiln.

This method differs from the above in that two or more large owners or a number of small-holders join together to erect a kiln, all expenses and profits being proportionally shared out. If this method is to be a complete success it is necessary that one man should be placed in full charge of manufacture and receive some consideration for his trouble. Such organisations as these have not, so far, proved popular.

Co-operative Manufacture.

The following account taken from a memorandum by Mr. Newbould, formerly District Officer, Kuala Selangor, of the working of two co-operative copra kilns in that district is of particular interest as it shows that, with careful supervision and training, the coconut small-holders are able to combine successfully. The number of such endeavours are slowly increasing in the Kuala Selangor district of Selangor, but all require a considerable amount of care and attention if financial losses due to faults arising from inexperience are to be avoided.

It is interesting to note that endeavours in this direction have so far only been successful amongst the Javanese.

Co-operative Kilns — Sabak Bernam.

(a) Sidang Long's Kiln.

This kiln was started in September, 1931 by fourteen small-holders combining and paying \$10 each. This was sufficient to build the kiln and also most of the shop adjacent which they regarded as an essential adjunct.

The main idea of the members was to rid themselves of unnecessary middle-men and to have a fund from which they could borrow for their general living expenses which hitherto had been done from the local shop. Each member sells his nuts to the kiln and is paid cash at the current market rate. Copra manufacture is done by coolies working under the direction of a manager who is also a member. The copra produced is sold direct to Penang and the money thus obtained goes into the kiln account, the members themselves not getting any direct profit from the drying of the copra.

Non-members may sell their nuts to the kiln and receive the same price as members do, but cannot borrow from the fund. At one time loans were tending to swamp the profits and a by-law had to be passed prohibiting members from borrowing more than \$10 at a time. The loans are settled on the occasion of the next sale of nuts to the kiln.

At the end of 1932, the kiln which was formerly a semi-enclosed half clay, half plank walled one, was rebuilt with bricks and the kiln house enlarged. Both of these undertakings were done from profits.

The accounts are kept by a book-keeper, who receives a small monthly salary, and are checked by the committee.

A profit of approximately \$490 was earned by this kiln during the period September 1931 to December 1932.

(b) To' Halus.

A similar Society to the one above was started about a mile away, during the latter part of 1932. The membership is smaller and owing to its inception at the time of keen competition, it has not met with the same success. The chief obstacle has been the absurdly high price prevailing for nuts, and the fact that members appear to be disinclined to accept slightly lower prices.

The kiln was not at first very satisfactory, being built of clay and planks without an enclosure, but at the beginning of 1933 this had been replaced by a brick-walled kiln and the society re-formed on a sounder basis.

Miscellaneous Articles.

THE SELANGOR BULK OIL INSTALLATION PLANT.

Introductory.

A further stage in the development of the Malayan oil palm industry was reached on August 22nd 1933 with the first shipment of oil in bulk from the Selangor Bulk Oil Installation Ltd., at Kampong Kuantan, Selangor by the Straits Steamship Co. m.v. "Rasa" to Singapore.

The Selangor Bulk Oil Installation Ltd. is a local Company formed for the purpose of transporting by sea to Singapore palm oil in bulk from certain estates in Selangor. On arrival at Singapore the oil is taken over by the Malayan Palm Oil Bulking Co. Ltd., the Service Company for Malaya, which arranges for its despatch by ocean-going steamers.

This development would not have been possible without the co-operation of the Straits Steamship Co. who constructed the motor-vessel "Rasa" specially for the coastal palm oil traffic to Singapore, since, in addition to the oil from Kampong Kuantan, the "Rasa" also conveys oil from certain estates situated on the Bernam River.

Messrs Cumberbatch & Co. Ltd. are the Secretaries and Agents for the Selangor Bulk Oil Installation Ltd.

Description of Plant

The installation at Kampong Kuantan has been erected on land leased from the Malayan Water Transport Co. Ltd., also a local Company, which engages in river and coastal transport of goods.

The plant comprises a small receiving tank for the oil, three 100 ton storage tanks, a boiler for the provision of steam to heat the oil, and a pumping installation and pipe-line for transferring the oil from the storage tanks to the ship.

Method of Working.

The oil is brought from the estates either by tank lorry or in drums. In the case of one or two small estates, which have river frontage, the drums are conveyed by barge to the installation.

The receiving tank is mounted on a weighbridge, so that all oil can be weighed on arrival before being pumped into one of the large storage tanks.

A small sample of oil is drawn from each charge of the receiving tank, the samples from various estates being bulked in separate bottles. Weekly determinations of acidity are carried out on the bulked samples of oil.



INSTALLATION FOR BULK SHIPMENT OF PALM OIL.

Each storage tank is provided with a closed steam coil for heating the oil, the temperature being taken by means of thermometers set in pockets at different heights in the tank. Further, the pumping installation has been so arranged that it is possible either to circulate the oil in a tank, thereby ensuring that the oil is thoroughly mixed before being shipped, or to transfer oil from one tank to either of the other two tanks.

On the day prior to despatch, the oil is heated to a temperature of approximately 120°C. and circulated as described above.

At this temperature there is no longer any solid fraction present in the oil, and further the viscosity is reduced sufficiently to enable the oil to flow freely. As far as can be ascertained, the quality of the oil is unaffected by heating to this temperature.

The oil is then ready for delivering to the m.v. "Rasa". This vessel is provided with six tanks, the total capacity being approximately 220 tons of oil. Owing however to the difficulty of navigating the vessel with a full load in the Selangor river, not more than 150—160 tons of oil can be carried with safety.

The pump installed has a delivery capacity of approximately 50 tons per hour. If a more rapid rate is required, the pumps on the m.v. "Rasa" are also available.

General.

The bulked oil shipped from the Kampong Kuantan installation is of high quality as the following figures, giving the results of acidity determinations for average samples from the first two shipments, show :

	Acidity (calculated as palmitic acid) per cent.
Shipment No. 1	... 2.3
Shipment No. 2	... 2.9

In conclusion the writer would like to draw attention to the commendable spirit of co-operation shown in developing this scheme, the results of which cannot fail to be of benefit to all concerned, as well as to the industry in general.

C. D. V. G.

CONDITIONS ON SMALL RUBBER HOLDINGS IN MALAYA.

3rd Quarter 1933.

*Prepared by the Economics Branch of the Department of Agriculture,
S.S. and F.M.S. in collaboration with the Field Branch of the
Department of Agriculture.*

Rainfall.

Reports from the various centres state that weather conditions throughout the country during July were normal, rainfall being fairly evenly distributed; in the Northern part of the Peninsula good rains were experienced and precipitation on the coast of Malacca and the Negri Sembilan showed the increase which generally occurs in July over this particular area; in North Perak, the Negri Sembilan and Pahang the rainfall was slightly in excess of the average for July.

In August on the Western side of the Peninsula the weather was on the whole normal, in the State of Perak and at Cameron Highlands, however, the rainfall was much above the average, and in the Larut and Matang districts of Perak the precipitation was practically double the recorded average; whilst in Malacca, more especially the coastal area, there was a drought.

The rainfall for the month of September was below average, the weather in general being hot and dry for the first three weeks with rain during the last week. Rainfall was evenly distributed in Kedah, showers being frequent, whilst on the coast of the Negri Sembilan and Malacca the rainfall was heavier than is usual during September; in Johore and Singapore the weather was hot and showery.

Prices.

Table I, which is appended, shows the ruling prices for the period, it will be seen that the price increased considerably compared with the previous quarter having reached the peak during July, in which month the average price was \$16.91 per picul for Standard Sheet and ranged between \$10 and \$18.70 and went even as high as \$20 per picul in two districts for the small-holders' product.

There was a slight decrease in price for all grades during August and September, the price per picul for the native product during the former month ranging between \$10 and \$18.50 per picul and during the latter month \$10 to \$16.

The quotations in the Table show the ruling prices from a large number of buying centres and it should be noted that such factors as transport and local competition, affect the prices secured by the small-holder for his rubber.

The following Table shows the trend of prices per picul at the end of each month, ruling in Singapore for Kampong rubber during the past 9 months of 1933.

			Smoked Sheet \$	Unsmoked Sheet \$	Scrap \$
January	...	...	8.00	7.00	3.20
February	...	...	7.50	6.70	2.40
March	...	...	7.60	6.80	2.50
April	...	...	7.80	6.80	2.70
May	...	...	11.80	11.00	5.00
June	...	...	13.50	12.25	5.00
July	...	...	17.50	16.00	7.00
August	...	...	15.00	14.00	6.00
September	...	...	15.00	14.00	5.50

Tapping.

The considerable increase in price during the quarter has resulted in further enlargement of the areas tapped. As regards tapping methods employed, reports from throughout the Peninsula indicate that consequent on the rise in price the quality of tapping has deteriorated greatly, and furthermore the practice of tapping daily, several panels on one tree, became fairly common, while deep tapping and extensive wounding were also reported. The reports suggest that these conditions are more general on Malay-owned holdings leased to Chinese or tapped on the bagi-dua system.

Areas out of Tapping on Small Holdings.

The method of estimating the area untapped among small holdings by means of counting the number of such holdings along the sides of main roads was again employed, the result of this computation is shewn in Table 11 and was applied to the known area of tappable rubber, 1927 planting and earlier.

As a result of the rise in the market price of the commodity large numbers of small holdings have recommenced tapping and production has expanded in consequence.

The total area of tappable rubber on estates of less than 100 acres which was untapped in the Federated Malay States in September 1933 is estimated on the foregoing system as amounting to approximately 48,989 acres as compared with 133,000 acres in March and 56,355 acres in June of this year.

The total area untapped in the Straits Settlements in September is estimated to be 17,658 acres as compared with 49,000 in March and 27,742 acres in June of this year.

Diseases.

Mouldy-Rot.—Reports from all centres show that mouldy-rot is still very prevalent, the incidence of the disease having increased somewhat due to the weather conditions during the period under review.

Outbreaks have been rather severe in the Muar, Batu Pahat and Kota Tinggi districts of Johore and it is reported that measures for prevention or cure have not been extensively adopted in these districts. In Segamat and Kluang, painting of diseased trees was practised with satisfactory results.

In the State of Perak mouldy-rot is present in all areas but has not as yet done excessive damage to bark anywhere, efforts to popularise the use of disinfectants are being maintained.

Pink Disease.—Small outbreaks of this disease were recorded in several districts in Kedah. Effective control measures were carried out as soon as the disease was observed.

Root Disease.—A few cases of root disease have been reported in Johore and in all cases technical advice was given.

Oidium Leaf Disease.—The only outbreak reported was a slight one on a number of small holdings at Labis, Buloh Kasap and Kuala Paya in Johore during September.

Grades of Rubber Made.

Figures of the percentages of the various grades of rubber produced, where these have been recorded, are as follows:—

Perak : Kuala Kangsar :—(figures from 6 dealers) smoked sheet 38, unsmoked sheet 24, scrap 32, lump 6.

Larut and Matang :—(figures from 12 dealers) smoked sheet 8, unsmoked sheet 62, Scrap 28, lump 2.

Alor Star : (figures from 6 dealers) smoked sheet 74, unsmoked sheet 14, scrap 12.

Negri Sembilan : Rembau, Kuala Pilah and Jelebu :—(figures from 7 dealers) smoked sheet 21, unsmoked sheet 60, scrap 19.

Penang and Province Wellesley : (figures from 26 dealers) smoked sheet 12, unsmoked sheet 72, scrap 16.

Malacca : All districts (32 dealers) : smoked sheet 29, unsmoked sheet 53, scrap 18.

TABLE I.
Rubber Prices in Straits dollars per picul (133½ lbs.)
3rd Quarter, 1933.

	Singapore standard sheet Average	Singapore for small holder's rubber at end of month	Penang for small holder's rubber	Perak	Selangor	Negri Sembilan	Pahang	Malacca	Province Wellesley	Kedah	Johore	
Smoked sheet.	16.91	17.50	—	10-18	JULY	13-19	11-19	12.30-18.70	15-20	16-20	12-20-16.50	12-18.50
Unsmoked sheet.		16	12-18.40	7-17		12-16	9-17.20	10-18	13-15	12-19	9.70-14	8-17
Scrap		7	5 15-7.50	1-6.50		2.50-6	2-7.50	3-7	3.50-6.50	4-8	3-7	2-7.50
					AUGUST							
Smoked sheet	16.25	15	—	11-15.50	13-17	10-17	11-18.50	14-18	12-16	12-19	10-18.50	
Unsmoked sheet		14	13-15.50	10-12.60	11.50-15	8-15	10-17	10-13.50	11-14.50	11-16	8-16.50	
Scrap		6	5.50-6.50	2-5	3-6	2-6	3-7	3-7	3-6.50	3-6.50	1.80-7	
					SEPTEMBER							
Smoked sheet.	15.91	15	—	11-14.50	10.35-16	12-15.50	10.50-15	12-15	10-15	13-15	10-15	
Unsmoked sheet.		14	11.50-13.50	9-13.50	11-15	9-13.25	8.50-14	10-13	9-14	10-13	7.50-13.80	
Scrap		5.50	5.50-7.50	1.50-5	3-7	2-5.25	1.50-6.50	3-8	3-6	4-6	1.70-7	

TABLE II.
Estimated Acreage of Tappable Rubber which was out of Tapping on Holdings of less than 100 Acres, at the end of September, 1933.

PERAK				SELANGOR				NEGRI SEMBILAN				PAHANG			
District	Total Tappable area	Total untapped area	Percentage	District	Total Tappable area	Total untapped area	Percentage	District	Total Tappable area	Total untapped area	Percentage	District	Total Tappable area	Total untapped area	Percentage
Batang Padang	37,288	5,220	14	Klang	18,879	3,020	16	Seremban	19,241	2,501	13	Raub	7,361	147	2
Kinta	34,180	2,392	7	Kuala Langat	29,263	1,756	6	Tampin	17,947	2,333	13	Kuala Lipis	15,951	2,712	17
Kuala Kangsar	43,485	435	1	Ulu Langat	38,867	1,943	5	Kuala Pilah	17,470	4,891	28	Bentong	13,600	1,632	12
Upper Perak	13,774	1,052	12	Ulu Selangor	30,632	2,144	7	Jebebu	6,270	313	5	Other Districts	31,223	3,747	12
Larut & Selama	51,407	6,168	12	Kuala Lumpur	21,174	2,444	8	Port Dickson	10,653	1,598	15				
Krian	9,751	1,462	15	Kuala Selangor	9,379	1,444	15								
Lower Perak	47,937	479	1*												
	237,822	17,868	8		148,194	11,307	8		71,581	11,636	16		68,135	8,238	12

MALACCA				PENANG & P. WELLESLEY				SINGAPORE			
District	Total Tappable area	Total untapped area	Percentage	District	Total Tappable area	Total untapped area	Percentage	District	Total Tappable area	Total untapped area	Percentage
Central	17,687	3,714	21	North	3,241	202	9	Singapore	12,781	3,067	24
Alor Gajah	31,357	7,533	24	Central	7,067	636	9				
Jasin	24,97	50	2	South	8,149	163	2				
				Dindings	7,279	1,092	15				
				Penang	11,114	1,111	10				
	74,045	11,297	15		36,850	3,294	9		12,781	3,067	24

The percentage of areas out of tapping in June, 1933, was as follows:—Perak 10, Selangor 12, the Negri Sembilan 19, Pahang 20, Malacca 22, Penang and Province Wellesley 16, Singapore 45.

* Estimated from same percentage as shown in Kuala Kangsar District.

† Estimated from mean percentage for remainder of State.

TABLE III.

**Estimated Production of Rubber by Estates of less than 100 Acres
in Area during the Period January to September, 1933.**

1933	F.M.S.	S.S.	U.M.S.	Total Malaya
January ...	8,180	2,199	5,727	16,106
February ...	6,232	1,592	4,979	12,803
March ...	7,441	1,948	5,447	14,836
April ...	7,271	1,749	5,876	14,896
May ...	9,331	2,245	6,825	18,401
June ...	10,192	2,536	6,274	19,002
July ...	11,065	2,577	8,143	21,785
August ...	10,111	2,893	6,714	19,718
September ...	9,807	2,893	6,775	19,475

Tendency to Abandon Rubber Cultivation for Alternatives.

Since the price of rubber has increased and remained fairly steady at the enhanced value, this tendency appears to have diminished.

General.

With the price of rubber remaining steady and showing a profit to the small-holder further considerable areas of temporarily abandoned mature rubber have been brought into tapping again during the quarter. The high price of the commodity during the month of July caused tapping to be commenced on a number of holdings on which it had been previously delayed in the State of Johore, this being particularly noticeable in the districts of Batu Pahat—Kluang, Senggarang, Muar and Segamat. Reports from Perak state that padi planting considerably reduced the incidence of tapping during the quarter, especially during the month of September.

It is stated that there has been a general marked improvement in sanitary conditions of small-holdings, slashing of blukar and rubber seedlings having taken place on many holdings.

DISTRICT AGRICULTURAL SHOWS.

(a) Ulu Langat District Show.

The second annual Ulu Langat District Agricultural Show was held at the Government Offices, Kajang on Sunday October 1st.

The show was formally opened by the Hon'ble the British Resident, Selangor in the presence of a number of Government Officials from the Agricultural and Co-operative Departments and a large gathering of local Malays. The Director of Agriculture, the Chief Field Officer and the Assistant Director of Co-operation were among those present.

There were eight competitive sections for padi, fruits, vegetables, minor economic crops, poultry and home industries. Most of these were well supported while the actual exhibits reached a fairly high standard. The best sections were those devoted to padi, vegetables grown by Chinese market-gardeners and poultry.

Besides the competitive classes, special exhibits were shown by the following :—

Yu Hwa School of Manual Arts. Various types of needle work, paintings, and pictures worked in silk etc.

8th. Troop of Boy Scouts. A model of a Scout camp and numerous black and white sketches of various natural objects.

Department of Agriculture. This exhibit aimed at illustrating methods of attacking the chief agricultural problems of the district connected with padi, rubber and poultry.

Under padi, specimens of the three most important pests, rats, stem-borers and *Leptocorisa* sp. were shown together with the damage they do to the padi plants and control measures to be adopted against them. Three pure strains of selected padis and their rices were exhibited, in conjunction with a small exhibit put up by the Kajang Rice Mill.

Under rubber—Mouldy Rot, its cause, effect and treatment was illustrated by actual specimens.

Poultry. A pair of cross-bred Kampong × Light Sussex, bred at Cheras Agricultural Station, a Kampong hen and a pure-bred white Wyandotte cock, together with eggs from the hens were shown, to illustrate the great improvement in size of bird and egg, obtained by the use of a good cock of European blood.

Other exhibits included avocado pears, Brazil nuts, coffee and tobacco.

Co-operative Department. Methods of egg testing and grading were demonstrated.

Malayan Fertilisers. An interesting exhibit of manures suitable for every variety of crop, together with actual plants showing the effect of these manures was staged.

During the day a badminton tournament was held, a lecture on poultry keeping was given by Mr. W. H. Barnes and in the evening cinema films belonging to the Agricultural and Co-operative Departments were shown.

The show was not only a success from an agricultural point of view but also provided a very enjoyable day for the local inhabitants.

(b) Kuala Selangor District Show.

The second annual Kuala Selangor District Agricultural Show was held at the District Office, Kuala Selangor on Tuesday October, 17th. The show was opened by H.H. the Sultan of Selangor in the presence of the Hon'ble the British Resident, Selangor, the Directors of Agriculture and Co-operation, the District Officers, Kuala Selangor, Klang, Ulu Langat and Kuala Langat, a number of Government Officials from the Agricultural, Co-operative and Health Departments and a large gathering of Malays from all parts of the district.

There were 13 competitive sections providing classes for padi, minor economic crops, fruits, vegetables, oils and fats, rubber, poultry and home industries. The outstanding sections were those devoted to vegetables, oils and fats, poultry, and mats made from Mengkuang and Pandan—and although in the remaining sections, only a small number of exhibits were received, many of them were of excellent quality.

Besides the competitive sections special exhibits were put up by:—

Federal Oil Mills.—Samples of coconut oil and coconut poonac.

Raja Musa Estate.—Oil palm bunches and palm oil.

Nipah Distillers.—Sugar and Gula Nipah.

Messrs Guthrie & Co.—Izal disinfectant for Mouldy Rot and Chicken powders.

Malayan Fertilisers.—Exhibits of fertilisers suitable for padi, vegetables, fruits etc.

Health Department.—Models of ideal kampong houses, propaganda in connection with Malaria, Small-pox, Hook-worm (*Ankylostomiasis*), demonstrated by a series of microscope slides and illustrated posters.

Co-operative Department. Demonstration on how to test eggs and how to grade them.

Agricultural Department: Copra. Special exhibit of model copra kilns showing good and bad designs—together with samples of good and bad quality copra and oil produced on such kilns. Also samples of copra from good and bad kilns after storage for 4 months.

Padi. Exhibits of the following padi pests and their control measures: -
Leptocorisa sp., rats, stemborers.

Fruits. Exhibits of Brazil nuts and avocado pears along with instructions on methods of propagation and cultivation.

Poultry. Models of chicken houses, feeding trough, nest box and a coop for broody hens, all suitable for kampong use.

Attaps. Exhibits of good and bad quality attaps with the faults indicated.

In the afternoon a boat race for the Chinese ferrymen and a football match was arranged and attracted a large and enthusiastic crowd.

In the evening a film prepared by the Health Department was shown, followed by a lantern lecture on 'Copra' and by further films prepared by the Agricultural and Co-operative Departments.

The show was extremely successful and was even an improvement on the very high standard set in the previous year. This was mainly due to excellent organisation and to the experience gained from the previous show.

H. J. S.

Reviews.

**Leefmans S. & van der Vecht J. Der Groote Agaatolak
(*Achatina fulica* Fer) in Nederlandsche Indie-
The Giant Snail in the Dutch East Indies
De Bergcultures 27th May 1933.**

The information in this interesting paper is drawn, to a great extent from existing literature. The economic importance of the giant snail (*A. fulica*) has been a subject for considerable discussion in recent years in Malaya and elsewhere, and it would appear that doubt still exists as to whether it can be ranked as a major pest. Indubitably, cases of damage, chiefly to recently planted out seedlings, frequently come to notice, but on investigation, apart from the annoyance naturally caused to a gardener by the loss of his plants, the actual harm done from an economic point of view, is of little account, and could, in a great many cases have been avoided had adequate care been taken for the protection of the plants.

The increase of the snail is slow, and it is not unlikely that had control measures been initiated when it was first observed, some twenty two years ago, it would have been either exterminated or its range considerably more restricted than it is today.

A brief bibliography of recent literature is given in the paper.

N. C. E. M.

S I S A L .

A Note on the Attributes of the Fibre and their Industrial Significance.

BY

S. G. Barker, Ph.D., D.I.C., F. Inst. P., M.I.C.E., F.R.S.E., F.Z.S., F.T.I.,
Bulletin No. 64 of the Empire Marketing Board. May 1933. Price 1s.

The purpose of this booklet is to call attention to the paucity of real scientific knowledge of the attributes and characters of the sisal fibre.

A brief survey of world production and of imports into Great Britain is given together with a note on methods of reproduction and harvesting practice in different countries. Figures are given to show the average composition of the ash of the leaves and of the average fibre content which appears to be influenced somewhat by numerous factors, such as age of leaf and dryness of habitat. Mention is made of the distribution and grouping of the fibres in the leaf and their suitability for direct mechanical extraction with the elimination of retting; while it is of historic interest to record that, in principle, the first machine, which was invented by a Franciscan friar and called the 'Raspador' is the basis of all subsequent machines used for extraction of this fibre.

In discussing decortication the necessity for a plentiful supply of clean water is stressed whilst, in drying the fibre, if artificial heat is employed, it needs careful adjustment to secure optimum conditions, regarding which much investigation is still desirable.

The nature of the fibre is discussed and tables (Tobler's) are given for grading the finished product according to colour, length and thickness of the fibres.

Tables of typical values on the chemical composition of fibres from different regions are included, together with notes on the methods employed in the estimation of those values and their utility in evaluating a sample.

There is an interesting section dealing with the microscopic characters of the fibres, their lignification, minute structure and such physical characters as ductility, rigidity, fineness, tensile strength, density and methods of differentiation from Manila fibre.

The properties of sisal which have led to its commercial application in cordage, twine etc. are mentioned and a plea is made for research in methods of treatment to render the fibre suitable for other uses and so to expand its commercial potentialities, especially since binder twine, one of the chief forms in which the fibre is utilised, is now a narrowing market owing to the extending use of combine harvesters in all the large grain growing countries.

An interesting comparison of some of the physical characters of sisal and manila when used as marine cordage under similar and exhaustive tests, shows that, while sisal rope absorbs water and swells more rapidly than manila, yet after protracted immersion, the differences in these respects became immaterial.

Referring to the Admiralty report wherein certain defects of sisal rope are cited as detrimental to its general adoption in the navy it is pointed out that arrangements are being made to use sisal for 50 per cent. of the towing, heaving and hauling lines and for its entire adoption in the manufacture of cordage for certain other purposes, while the defects mentioned, it is stated, are capable of elimination by scientific investigation and research.

Methods of softening sisal fibres are briefly discussed as it is suggested that, if the fibre could be satisfactorily softened, a variety of new uses could be found for it along paths which are at present closed on account of its hardness.

Possible new uses for sisal fibre are suggested including moulding materials, sacking, hat braid, matting, hammocks, brushes, shoe tops, paper, thermal and electrical insulation and power alcohol production from waste though most of these uses would not result in a high consumption of fibre. The need for research on the production and particularly on the utilisation of sisal fibre is stressed in order to enable it to compete in the world's markets especially in the direction of new uses on which progress in the industry must be based.

The booklet is a compendium of reliable up to date information and from it emanate many inspiring suggestions which should prove useful to research workers along various lines of enquiry.

H. W. J.

FROM THE DISTRICTS.

The Weather.

In Kedah, Province Wellesley and Penang Island in the north, and in Singapore Island and parts of southern and eastern Johore in the south there was a good rainfall which, especially in the north, was well up to the average for the month. In Perak the precipitation was below average, the deficiency becoming more marked towards the southern end of the State and merging into the very dry conditions experienced in Selangor, Negri Sembilan, Kelantan and Pahang. The deficiency of rainfall was somewhat less extreme in Malacca and parts of northern and central Johore, but in these areas the second half of the month was hot and dry.

On the east side of the Peninsula the north-east monsoon had not broken at the close of the month and was, therefore, late, although its influence was felt in the north-western area.

Remarks on Crops.

Rubber. The average price of rubber remained about the same as in September. The highest and lowest prices in dollars and cents per picul recorded during the month for rubber from small holdings were:—Smoked Sheet \$9—\$16.50; Unsmoked Sheet \$7.50—\$15.50; Scrap and Lump \$1—\$8. The average Singapore prices recorded for small-holders' rubber were:—Smoked Sheet \$15.50; Unsmoked Sheet \$14.50; Scrap \$5 as compared with \$15, \$14 and \$5.50 in September. The Penang prices for Unsmoked Sheet ranged from \$12.60—\$14.40 as against \$11.50 to \$13.50 in September.

There has been a still further and quite considerable increase in the number of both large and small holdings tapped in all parts of the Peninsula. This has been assisted by the completion of padi planting in several areas. Severe tapping on two or more panels was becoming common. As tapping is often done by the children, while the adults earn money in other ways, the actual work of tapping is often unskilfully performed. Consequently, trees are often severely wounded even on properties on which tappers, paid on the half-share system, are not employed.

Clearing of undergrowth to facilitate tapping caused some improvement in the appearance of small holdings. Somewhat better attention was given to the treatment of Mouldy Rot disease by owners and the use of approved cheap disinfectants showed an increase as facilities for obtaining them were further extended.

Padi. The price of padi at the Government Rice Mill, Bagan Serai, continued to be \$1.70 per picul. There was a slight fall in price in Kedah towards the end of the month and in Province Wellesley the price was as low as \$5.50—

\$5.60 per 100 gantangs. Elsewhere prices showed little change from those of September and mostly ranged between 7 and 10 cents per gantang.

Padi planting was nearing completion in most parts of the Peninsula, though much work still remained to be done in several important areas, as for example Kuala Selangor district, Raub district in Pahang and several parts of Kelantan where unusually dry weather conditions have caused delay. Prospects for the coming harvest are very promising in Kedah, Province Wellesley, Krian, Malacca and parts of Pahang.

Two new rice mills have commenced work in Kedah. From this State it is also recorded that enquiries were made from Sumatra as to the possibility of obtaining hand-milled rice from the weekly fairs or in other ways.

It was observed in Johore that neighbouring padi planters were offering 20 cents a gantang, or twice the current market price, for seed of certain pure strain padis grown in an old sawah to which these strains were distributed by the Department of Agriculture five years ago. This is an interesting illustration of the demand that can arise for the seed of a pure strain once it has established a local reputation.

The fresh water crab common in parts of Kedah made its appearance as a pest of padi in the north of Province Wellesley. The pot traps and fish traps used in Kedah were employed for its control, but were not available in sufficient numbers, so that in the last resort water had to be drained off the fields and the crabs collected by hand. Rats proved troublesome in Negri Sembilan and even more so in Johore.

Coconuts and Copra. There was a further decline in the price of copra which averaged \$2.65 per picul in Singapore and \$2.60 in Penang. Prices in various centres ranged during the month from \$1.40 to \$3.25 with a maximum of \$4.50 per picul in Kedah.

In spite of the fall in price the number of Malays who prepare their own copra is steadily increasing. The tour of the Rural Lecture Houseboat and the visit of the Copra Instructor to the villages along the Pahang river has roused considerable interest in copra preparation among the Malays of Temerloh and Pekan districts in the former of which three new kilns are being erected. This movement has also extended to the west coast of Johore and to part of Kelantan. In Selangor the quality of the copra is improving.

The price of copra is, however, so low that in some localities it is more profitable to sell the nuts for eating or, as in Malacca, to sell home-made coconut oil.

Pineapples. Harvesting of the second main crop for the year commenced towards the end of the month. Yields were small at first but increased rapidly. Three factories were working in Johore and two in Singapore. In the areas in Johore where they are planted as a sole crop pineapples appear to be growing well.

Tuba Root. The price of dried root in Singapore rose considerably during the month and at its close stood at \$40 per picul for good root. This rise may be due in part to large orders for planting material received from intending planters mainly in Sumatra. A total of 61,500 cuttings were despatched to Sumatra and Pahang. Other enquiries have been numerous and some remain to be supplied.

Agricultural Stations.

At all Stations work, including the planting up or supplying of permanent crops, proceeded normally. Plots of one year old tea were pruned at Rembau Station and the final pruning was given in the experiments on pruning young tea at the Tanah Rata Station on Cameron Highlands. The results of these experiments indicate that on the Highlands the young bushes should be allowed to grow at least four months and for not more than seven between prunings. The wood to be left between cuts will then have to be about $1\frac{1}{2}$ inches to bring the bushes to 9 inches high at the time of their final pruning before tipping. Tobacco curing was in progress at Kuala Kangsar and Temerloh Stations and also at the Pineapple Experiment Station, Singapore, where there is a barn for flue curing. Fruiting had commenced on all the plots of mature pineapples under experiment at this Station.

Padi Test Plots.

Planting was well advanced or actually completed on all Padi Test Plots except those in the Panchang Pedena area of Kuala Selangor district where transplanting was delayed by lack of water.

Harvesting of all varieties except F.S. 824 was completed at Kajang Test Plot in Selangor. Satisfactory yields between 340 and 495 gantangs per acre were obtained, the best varieties were F.S. 756 giving 495 gantangs per acre and Padi Kelantan with 446 gantangs per acre. F.S. 824 has proved to be of no use as an inter-season strain. Harvesting was also in progress at the Kuang Padi Test Plot in Selangor but was not completed for all strains. Yields were low owing to damage by pests the best strain so far being Radin Siak with a yield of 210 gantangs per acre.

Home Gardens Competitions.

Home gardens were judged finally in the Lenggong Sub-district of Upper Perak, there being 91 entries and the competition was considered to have been a distinct success. Similar competitions in the Klang and Kuala Langat districts of Selangor were completed successfully. Entries for competitions in Pahang East were 111 in Kuantan and 130 in Pekan district. The judges considered

the standard reached to be satisfactory. The competitions have aroused considerable interest in the growing of vegetables on Malay small holdings and such production is further stimulated if there are weekly fairs close at hand where surplus produce can readily be sold.

Weekly Fairs.

Weekly fairs remain popular and serve a useful purpose in most parts of the country. Two new fairs were opened in Kedah and two in eastern Pahang. In Klang district of Selangor, however, the fairs are not doing so well as in the inland areas, owing to the small number of outside buyers, the fact that the majority of the small-holders grow their own vegetables and the proximity of large villages and the town. In Muar district of Johore, just a year after weekly fairs were started, less than half a dozen survive out of seventeen originally opened, while it is doubtful if most of the surviving fairs are fulfilling their correct purpose.

Bee Keeping.

Three wooden-frame hives of the standard size used in Java for *Apis indica* were presented to the Department of Agriculture, Kedah, by Mr. J. J. Oehse of the Department of Agriculture and Commerce, Netherlands India. In two of these local swarms of the bee have been placed for preliminary observations.

From Johore it is reported that a certain Chinese in Parit Ibrahim Ulu, Pontian, has established 15 hives of bees. The honey is collected once a month during full moon and one bottle per hive is said to be produced each month. The honey is sold to Chinese in the district for medicinal purposes at 30—45 cents per bottle.

It may be added that several exhibits of honey in bottles were shown at the Kuala Selangor District Show.

DEPARTMENTAL NOTES.

Visits and Tours.

The Director of Agriculture, Dr. H. A. Tempany, C.B.E., accompanied by the Chief Field Officer, Mr. F. W. South, attended the District Agricultural Show at Kajang on October 1st and at Kuala Selangor on October 17th.

The Agricultural Field Officer, Selangor, Mr. H. J. Simpson, also attended both Shows and the Assistant Economic Botanist, Mr. R. B. Jagoe, attended the Kajang Show to assist in judging the padi exhibits.

The Director proceeded to Singapore on October 12th and again on October 26th for the purpose of holding a Conference on matters connected with the Malayan Pineapple Industry. During these visits he conferred with the Hon'ble the Colonial Secretary and other officials.

On October 27th—28th the Director paid a visit to Malacca and inspected the work in progress at the Pulau Gadong Padi Experiment Station and the Agricultural Station, Sungei Udang, and conferred with the Hon'ble the Resident Councillor, The Inspector of Schools and the Agricultural Field Officer.

The Rural Lecture Caravan.

The Caravan proceeded to Kuala Lipis on August 8th 1933 and conveyed the necessary apparatus and exhibits for a tour of the riverine mukims of Kuala Lipis, Temerloh and Pekan districts by House-boat.

The tour, which continued until September 12th, was most successful and proved of considerable interest to the inhabitants of the scattered Kampongs in the neighbourhood of the centres visited.

Staff Changes and Leave.

Mr. J. L. Greig, Assistant Agriculturist, returned from leave and reported for duty in Kuala Lumpur on October 13th 1933.

Statistical.

MARKET PRICES

October 1933.

Rubber.—The price of rubber has fluctuated somewhat during the month, opening at 14½ cents per lb. for Spot loose in Singapore and closing at 13 cents per lb. The average price for the month was 12 15/16 cents per lb. in Singapore, 3 31/32 pence in London and 7 9/16 cents Gold in New York as compared with 11 15/16 cents, 3 11/16 pence and 7 cents Gold respectively in September.

Palm Oil.—The course of the English market during October on a basis of 18 per cent., f.f.a., c.i.f. Liverpool was as follows:—October 5th £14.10.0. per ton, market weak, October 12th £14.0.0. per ton, market quiet, October 19th £14.15.0. per ton market steady and October 26th £15.0.0. per ton market firmer.

Prices in the U.S.A. landed weight per pound in bulk c.i.f. New York/Philadelphia were 2.70 cents Gold on the 7th October; 2.70 cents Gold on the 14th October; 2.50 cents Gold on the 21st October and 2.60 cents Gold on the 30th October.

The price of palm kernels Fair Average Malayan Quality c.i.f. landed weight on the continent was 7s. 6d. per cwt. on the 7th October; 7s. 6. per cwt. on the 14th; 7s. 7½d. per cwt. on the 21st October and 7s. 9d. per cwt. on the 30th October.

Copra.—There was again a slight fall in price when compared with ruling prices in the previous month, the highest Singapore price for Sundried during October was \$3.30 per picul, and the lowest price \$3.15 per picul, the average price per picul being \$3.20 as compared with \$3.42 per picul during September. The mixed quality averaged \$2.60 per picul as compared with \$2.87 in September.

Coffee.—The price at Singapore for Sourabaya coffee remained steady during the month, but there was a slight fall in prices as compared with the prices quoted in September. Prices ranged according to grade, from \$16 to \$18 as compared with \$17.50 to \$19.50 during September. Palembang coffee averaged \$12.56 during the month being quoted at \$12.50 on the 6th and \$12.75 on the 27th, the average figure for October was \$12.56.

Arecanuts.—Palembang's averaged \$1.85 and Bila Whole \$2 per picul as compared with \$2.27 and \$2.15 during September. The range of Singapore prices for other grades was:—Split \$1.60 to \$3.85; Red Whole \$3 to \$4.25; Sliced \$6.50 to \$8 and Kelantan \$2.25 to \$3.

Gambier.—There was a further slight fall in the price of Block Gambier during October, the average price being \$4.33 per picul, Cube No. 1 averaged \$7.50. Corresponding figures for September were \$4.50 and \$7.50 respectively.

Pineapples.—Values decreased slightly during October, the average Singapore price per case being as follows :—Cubes \$3.15, Sliced Flat \$3.08 and Sliced Tall \$3.20 as compared with \$3.30, \$3.30 and \$3.30 during September.

Tapioca.—The price of Flake Fair averaged \$4.41 as compared with \$4 in September. Pearl Seed averaged \$5.26, a slight increase over September price of \$5, and Pearl Medium averaged \$5.46 the average price being \$5 in the previous month.

Sago.—Pearl—Small Fair declined further in price, averaging \$3.81 during the month. Flour-Sarawak Fair averaged \$1.72½ as compared with \$1.77 in September.

Mace.—Prices ruling during the month were similar to September prices, namely \$70 per picul for Siouw and \$50 for Amboina.

Nutmegs.—Prices continued steady, after a fall in value in the first part of the month. Singapore price per picul for 110's was \$19 and 80's averaged \$25 having averaged \$26 in the previous month.

Pepper.—Average Singapore prices during October were as follows :—Singapore Black \$12.83 per picul; Singapore White \$22.41 and Muntok White \$22.87, the corresponding figures for September were \$13.12, \$21.94 and \$22.56 respectively.

Cloves.—As in the previous months the demand for cloves remains small, nominal prices being \$40 for Zanzibar and \$45 per picul for Amboina.

GENERAL RICE SUMMARY.

Malaya.—Gross foreign imports of rice (including stocks available for re-export) during September 1933, amounted to 47,960 tons, as compared with 54,548 tons in September 1932, of which 45 per cent. were consigned to Singapore, 15 per cent. to Penang, 8 per cent. to Malacca, 22 per cent. to the Federated Malay States and 10 per cent. to the Unfederated Malay States.

Of these imports, 59 per cent. were from Siam, 38 per cent. from Burma, 2 per cent. from Indo-China and 1 per cent. from other countries.

Total foreign exports of rice from Malaya in September 1933, were 13,368 tons (including 177 tons local production) as compared with 15,345 tons in September 1932.

Of these exports 76 per cent. were consigned to Netherlands India and 24 per cent. to other countries.

Net imports for the period January to September 1933, were 315,871 tons as compared with 306,338 tons during the same period for 1932, an increase of 3.1 per cent.

India and Burma.—Total foreign exports of rice during August 1933, were 159,000 tons as compared with 131,000 tons in the previous month and 113,000 tons in August 1932.

Total exports during the period January to August 1933 were 1,465,000 tons as compared with 1,650,000 tons for the corresponding period of 1932, a decrease of 11 per cent.

Siam.—Exports (approximate) during September 1933, amounted to 126,942 tons as compared with 131,255 tons in September 1932, a decrease of 3 per cent.

Netherlands India, Java and Madura.—For the period end of August 1933, the area harvested amounted to 8,150,000 acres a decrease of 14,000 acres or 0.2 per cent. as compared with the corresponding period of 1932: the area damaged was 420,000 acres an increase of 93,000 acres or 28 per cent. as compared with 1932, and additional plantings awaiting harvesting amounted to 1,297,000 acres an increase of 68,000 acres or 15 per cent. The total acreage at the end of August 1933, amounted to 9,867,000 acres, an increase of 246,000 acres or 3 per cent. as compared with the same period in 1932.

Imports of rice into Java and Madura January to July 1933, totalled 104,149 tons, an increase of 5,099 tons or 5 per cent. as compared with the same period of 1932.

Imports of rice into the Outer Provinces January to July 1933, amounted to 151,585 tons, an increase of 7,251 tons or 5 per cent. as compared with the same period of 1932.

French Indo-China.—Entries of padi at the port of Cholon from January to September 1933, amounted to 910,000 metric tons, an increase of 27,000 tons or 3 per cent. as compared with the same period of 1932.

Exports of rice from Saigon for the period January to September 1933 totalled 1,035,000 tons, an increase of 130,000 tons or 14 per cent. as compared with the corresponding period of 1932.

Ceylon.—Imports for the period January to August 1933, totalled 298,886 tons, a decrease of 11,252 tons on the imports for the same period of 1932.

Of these imports 19 per cent. were from British India, 81 per cent. from other countries.

Europe and America.—Quantities of rice shipped from the East were :—

- (a) To Europe for the period January 1st to September 21st, 1,028,482 tons, an increase of 224,013 tons or 28 per cent. as compared with the same period of 1932. Of these shipments 51 per cent. were from Burma, 2 per cent. from Japan, 39 per cent. from Saigon, 7 per cent. from Siam and 1 per cent. from Bengal, as compared with 54 per cent. from Burma, 3 per cent. from Japan, 36 per cent. from Saigon, 4 per cent. from Siam and 3 per cent. from Bengal in 1932.
 - (b) To the Levant, period January 1st to August 26th, 21,087 tons, a fall of 22,643 tons or 52 per cent. as compared with the same period of 1932.
 - (c) To America and the West Indies for the period January 1st to August 21st, 1933, 119,703 tons, an increase of 25,223 tons or 27 per cent. as compared with the same period of 1932.
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MALAYA RUBBER STATISTICS

ACREAGES OF TAPPABLE RUBBER NOT TAPPED ON ESTATES OF 100 ACRES AND OVER, FOR THE MONTH ENDING September 1933.

STATE OR TERRITORY	Acreage of Tappable Rubber end 1932	ESTATES WHICH HAVE ENTIRELY CEASED TAPPING				ESTATES WHICH HAVE PARTLY CEASED TAPPING				Total (3) + (5) (7)	Percentage of (7) to (2) (8)
		Acreage (3)	Percentage of (3) to (2) (4)	Acreage (5)	Percentage of (5) to (2) (6)	Acreage (5)	Percentage of (5) to (2) (6)				
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)				
STRAITS SETTLEMENTS :—											
Province Wellesley	44,734	1,447	3.2	8,415	18.8	9,862	22.0				
Dindings	6,969	209	3.0	950	13.6	1,159	16.6				
Malacca	111,780	4,995	4.4	18,456	16.5	23,451	20.9				
Penang Island	1,635	626	38.3	255	15.6	881	53.9				
Singapore Island	28,269	10,560	37.3	4,656	16.5	15,216	53.8				
Total S.S.	193,387	17,837	9.2	32,732	16.9	50,569	26.1				
FEDERATED MALAY STATES :—											
Perak	250,951	7,484	3.0	35,449	14.1	42,933	17.1				
Selangor	308,379	9,312	3.0	41,224	13.4	50,536	16.4				
Negeri Sembilan	228,541	8,116	3.5	22,526	9.9	30,642	13.4				
Pahang	38,141	6,145	16.1	5,165	13.5	11,310	29.6				
Total F.M.S.	826,012	31,057	3.8	104,364	12.6	135,421	16.4				
UNFEDERATED MALAY STATES :—											
Johore	325,747	26,683	8.2	34,500	10.6	61,183	18.8				
Kedah (a)	114,551	5,254	4.6	8,984	7.8	14,238	12.4				
Kelantan	21,175	6,825	32.2	2,272	10.7	9,097	42.9				
Trengganu (b)	4,352	Nil	Nil	2,072	47.6	2,072	47.6				
Perlis (a)	957	177	18.5	468	48.9	645	67.4				
Total U.M.S.	466,782	38,939	8.3	48,296	10.3	87,235	18.6				
Total MALAYA	1,486,181	87,833	5.9	185,392	12.5	273,225	18.4				

Notes :— (a) Registered companies only and are rendered quarterly.

(b) Registered companies only.

The above table together with a Summary, was prepared and published by the Statistics Department, S.S. and F.M.S. in October 1933.

MALAYAN AGRICULTURAL EXPORTS, SEPTEMBER 1933.

Product	NET EXPORT IN TONS.				
	Year 1932	Jan-Sept. 1932	Jan-Sept. 1933	Sept. 1932	Sept. 1933
Arecanuts ...	20,280	15,441	14,930	1,826	1,417
Coconuts, fresh † ...	108,123	89,970	78,454	6,726	10,388
Coconut oil ...	11,932	8,132	13,048	812	1,289
Copra ...	97,464	65,951	73,037	10,772	12,492
Gambier, all kinds ...	2,925	2,404	1,802	301	165
Palm kernels ...	1,248	843	1,433	91	285
Palm oil ...	7,892	5,398	7,118	851	988
Pineapples, canned ...	66,291	54,464	49,718	3,735	2,873
Rubber § ...	417,137	305,511	331,796	33,315	39,897
Sago,—flour ...	10,267	6,562	2,605	1,336	245*
„ —pearl ...	3,128	2,136	1,644	248	214
„ —raw ...	4,148*	3,028*	3,070*	332*	421*
Tapioca,—flake ...	9,028	7,193	7,950	868	711
„ —flour ...	392	191*	195*	1*	69*
„ —pearl ...	19,977	15,371	12,932	1,459	1,324
Tuba root ...	165½	98	343½	15	30

† hundred in number.

§ production.

* net imports.

MALAYAN PRODUCTION IN TONS OF PALM OIL AND KERNELS
THIRD QUARTER, 1933.

(As declared by Estates).

			Palm Oil		Palm Kernels	
			F.M.S.	Johore	F.M.S.	Johore
1933	July	...	883.9	334.6	141.1	110.5
	August	...	1147.3	559.5	188.9	127.0
	September	...	1128.7	302.1	180.5	56.9
TOTAL			3159.9	1196.2	510.5	294.4

MALAYA RUBBER STATISTICS TABLE I
STOCKS, PRODUCTION, IMPORTS AND EXPORTS OF RUBBER, INCLUDING LATEX, CONCENTRATED LATEX AND REVERTEX,
FOR THE MONTH OF SEPTEMBER 1933 IN DRY TONS.

Territory	Stocks at beginning of month 1				Production by Estates of 100 acres and over		Production by Estates of less than 100 acres estimated 2		Imports				Exports including re-exports				Stocks at end of month	
	Ports	Dealers	Estates acres and over	January during the month Sept. 1933	January during the month Sept. 1933	January to Sept. 1933	Foreign	From Malay States Labuan	during the month		January to Sept 1933		during the month		January to Sept 1933		Ports	Dealers acres and over
									Foreign	Labuan	Foreign	Malay States Labuan	Foreign	Local	Foreign	Local		
MALAY STATES :—																		
Federated Malay States	...	13,270	11,744	11,725	100,222	9,807	79,630	NH	NH	NH	NH	14,533	7,394	126,720	56,356	...	13,084	11,520
Johore	...	3,211	3,036	3,469	32,031	4,378	39,073	NH	16	NH	115	1,715	6,692	12,182	59,139	...	3,158	2,742
Kedah	...	464	2,071	2,610	20,970	1,378	12,057	NH	NH	NH	NH	1,356	2,602	11,059	22,665	...	437	2,134
Perlis	...	15	11	12	11	21	108	NH	NH	NH	NH	NH	36	NH	201	...	11	12
Kelantan	...	331	199	227	1,606	710	4,930	NH	330	NH	103	816	702	5,897	...	...	323	295
Tengganu	...	55	50	182	1,186	91	592	NH	NH	NH	NH	NH	273	NH	1,778	...	55	50
Total Malay States	...	17,346	17,117	18,225	156,086	16,582	136,390	NH	16	330	115	17,707	17,813	150,663	146,036	...	17,068	16,683
STRAITS SETTLEMENTS :—																		
Malacca	...	3,277	1,270	1,396	11,806	...	...	1	NH	NH	11	3,403	...	35,621	...	...	3,455	1,255
Province Wellesley	...	1,167	728	540	4,618	...	...	NH	17,871	NH	146,527	6,850	NH	57,363	...	...	1,157	761
Dindings	...	98	138	115	888	2,893	20,632	1,165	6,298	...	...	...	...	...	...	...	47	170
Penang	...	1,362	5,521	12	1	41	...	10,298	78,657	...	...	...	...	...	...	...	1,571	5,511
Singapore	...	8,253	31,502	145	135	1,325	...	...	...	...	...	...	...	...	...	...	9,536	30,185
Total Straits Settlements	...	9,615	41,495	2,293	2,197	18,688	2,893	20,632	11,464	17,871	84,966	146,527	31,900	156,585	NH	...	11,107	40,349
TOTAL MALAYA	...	9,615	58,841	19,410	20,422	174,774	19,475	157,022	11,464	17,887	85,296	146,642	49,607	17,813	400,232	146,036	11,107	57,417

TABLE II

DEALERS' STOCKS IN DRY TONS 3

Class of Rubber	Federated Malay States	S'pore	Penang	Province Wellesley	Dindings	Johore	Kedah
20	21	22	23	24	25	26	27
DRY RUBBER	9,670	25,784	5,075	4,431	1,480	159	...
WET RUBBER	3,414	4,401	436	222	1,678	278	...
TOTAL	13,084	30,185	5,511	4,653	3,158	437	...

TABLE III
FOREIGN EXPORTS

PORTS	For month	January to Sept. 1933
Singapore	...	31,651
Penang	...	10,979
Port Swettenham	...	5,933
Malacca	...	1,044
MALAYA	...	49,607

TABLE IV
DOMESTIC EXPORTS 4

AREA	For month	January to Sept. 1933
Malay States	...	37,245
Straits Settlements	...	316,770
MALAYA	...	37,245

Notes:— 1. Stocks on estates of less than 100 acres and stocks in transit on rail, road or local steamer are not ascertained.

2. The production of estates of less than 100 acres is estimated from the formula: Production + Imports + Stocks at end of month + Consumption. Columns [7] = Columns [13] + [14] + [17] + [18] + [19] + 15 tons latex consumed during the month — [2] — [3] — [4] — [5] — [9] — [10]. For the Straits Settlements, Columns [9] and [10] represent purchases by dealers from local estates of less than 100 acres, reduced by 15 tons of domestic production.

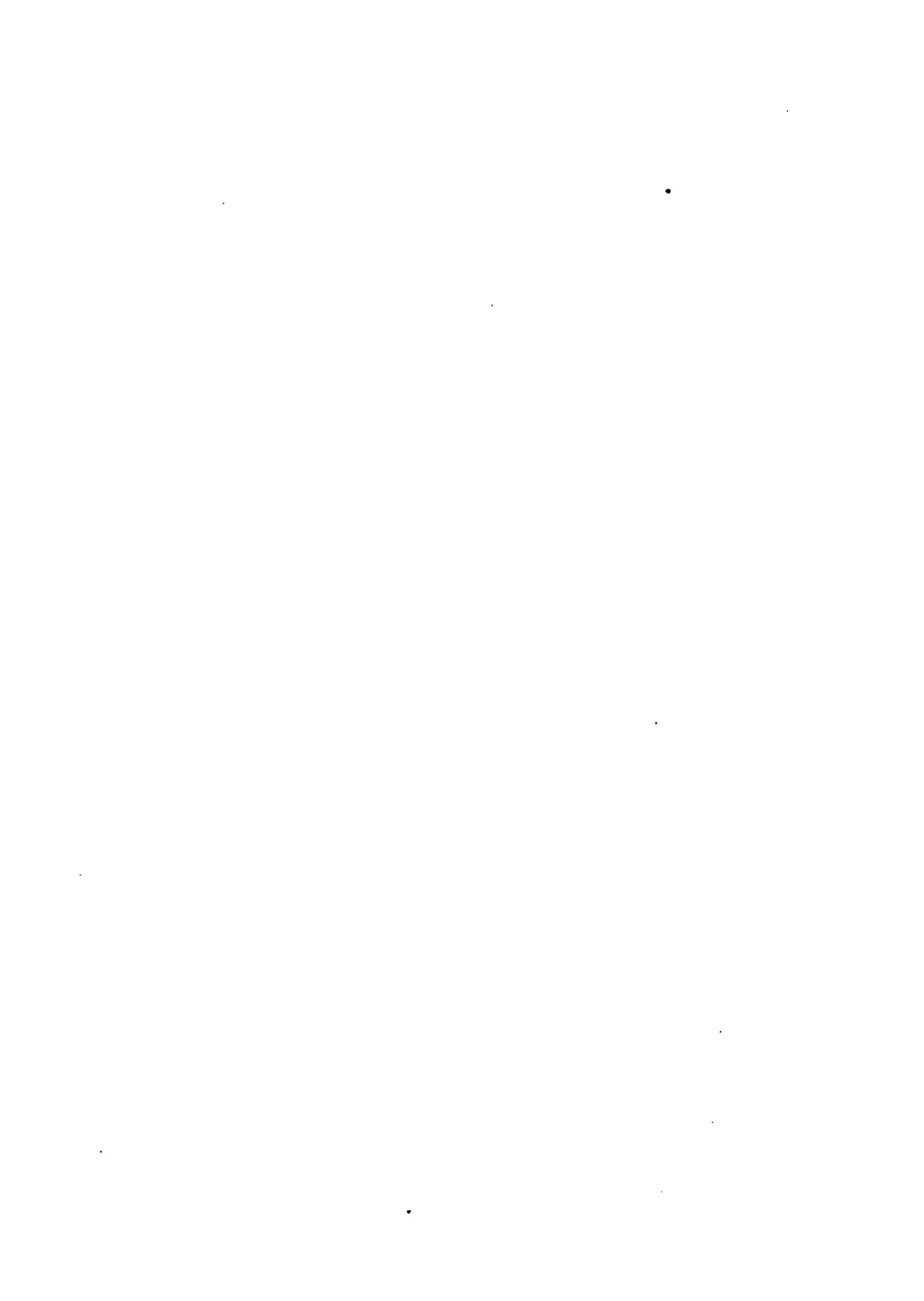
3. Dealers' stocks in the Federated Malay States are reduced to dry weights by the following factors: unsmoked sheet, 152; wet sheet, 25; scrap, lump, etc., 40; stocks elsewhere are in dry weights as reported by the dealers themselves.

4. Domestic exports are estimated by deducting the average monthly dry weight of foreign imports over a period of 2 months from the gross foreign exports of the later month, the foreign exports of the Malay States being domestic production.

5. The above, with certain omissions, is the Report published by the Registrar-General of Statistics, S.S. and F.M.S., at Singapore on 23rd October

METEOROLOGICAL SUMMARY, MALAYA, SEPTEMBER, 1933.

LOCALITY	AIR TEMPERATURE IN DEGREES FAHRENHEIT					EARTH TEMPERATURE		RAINFALL					BRIGHT SUNSHINE					
	Means of			Absolute Extremes		At 1 foot	At 4 feet	Total		Most in a day		Number of days			Total	Daily Mean	Per cent	
	A.	B.	Mean of A and B	Highest	Lowest			mm.	in.	Precipitation, 0.1 in or more	Thunderstorm	Fog morning obs.	Gale force 8 or more					
	Max.	Min.	°F	°F	°F	°F	°F	°F	mm.	in.	mm.	in.	Thunderstorm	Fog morning obs.	Gale force 8 or more	°F	°F	Per cent
Railway Hill, Kuala Lumpur, Selangor	89.8	71.6	80.7	93	69	86	74	84.1	84.9	7.77	197.4	2.05	18	16	6	169.40	5.65	47
Bukit Jeram, Selangor	88.6	72.8	80.7	91	71	85	75	84.6	86.2	4.80	121.9	2.48	13	9	3	196.20	6.54	54
Sitiawan, Perak	90.5	72.8	81.7	94	70	86	74	85.0	85.6	4.25	108.0	1.62	14	9	1	194.55	6.49	54
Kroh, Perak *	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Temerloh, Pahang	89.6	71.8	80.7	92	69	86	74	83.9	86.0	12.06	306.3	2.31	22	17	1	190.05	6.33	52
Kuala Lipis, Pahang	88.9	71.2	80.0	92	69	83	74	84.4	85.3	6.43	163.3	2.65	15	12	3	190.10	6.34	52
Kuala Pahang, Pahang	87.1	73.0	80.1	92	70	83	75	84.3	85.4	7.47	189.8	2.65	16	12	3	208.10	6.94	57
Mount Faber, Singapore	87.0	73.8	80.4	92	69	79	79	82.4	83.3	6.03	153.2	1.75	18	13	5	176.20	5.87	49
Butterworth, Province Wellesley	87.8	73.8	80.8	90	71	83	75	84.4	85.2	10.74	272.8	1.44	23	18	1	198.55	6.62	55
Bukit China, Malacca	84.4	73.4	78.9	87	70	80	76	82.6	84.0	12.25	311.2	2.92	18	16	7	173.30	5.78	48
Kluang, Johore	86.9	70.9	78.9	92	69	78	73	81.5	82.0	7.54	191.5	2.16	16	12	2	145.80	4.86	40
Bukit Lalang, Mersing, Johore	87.0	71.5	79.3	91	68	77	74	81.5	82.0	7.39	187.7	1.26	16	15	7	181.35	6.05	50
Alor Star, Kedah	87.6	74.0	80.8	90	71	83	77	86.1	86.1	6.48	164.6	0.94	23	21	4	197.75	6.59	54
Kota Bharu, Kelantan	89.3	73.1	81.2	93	70	82	76	84.5	85.3	9.45	240.0	1.90	22	18	2	194.15	6.47	53
Kuala Trengganu, Trengganu	87.9	72.2	80.1	90	68	84	75	83.4	84.8	5.97	151.7	1.67	16	13	1	189.95	6.33	52
HILL STATIONS.																		
Fraser's Hill, Pahang 4268 ft.	74.8	62.6	68.7	78	60	71	65	71.4	72.0	5.78	146.8	1.90	17	12	2	155.60	5.19	43
Pahang Highlands, Tanah Rata, Pahang 4750 ft.	71.7	56.8	64.3	75	53	69	62	70.4	69.7	3.85	97.8	1.39	16	13	3	141.90	4.73	39
Cameron Highlands, Rhododendron Hill, Pahang 5120 ft.	71.4	59.0	65.2	75	57	68	61			4.09	103.9	1.43	15	12	1	147.45	4.91	41



NOTICE TO SUBSCRIBERS.

The present number of this Journal completes the twenty-first Volume. The Index to this Volume will be forwarded to subscribers in January 1934.

THE Malayan Agricultural Journal.

DECEMBER, 1933.

EDITORIAL.

Rice in Malaya.

The present enlarged number of this Journal contains articles relating to the crop which forms the staple food of the great majority of the population of Malaya, namely

rice.

For the two decades between 1910 and 1930, the production and export of rubber dominated the agricultural outlook in Malaya by reason of the large profits obtained from its sale, but even during this period the Malay peasant continued, somewhat reluctantly, to till his ancestral padi field, leaving the tapping of his rubber trees to a paid labourer. In the first of these decades, the Department of Agriculture, so far as the limited staff available during the war period would allow, endeavoured by the selection of high yielding strains of padi at the Titi Serong Experiment Station to increase the crop obtained from the area then cultivated.

The rubber slump of 1921, corresponding as it did with a shortage in the world's rice supply, administered a severe shock to the edifice of agricultural prosperity erected on the weak foundation of a single export crop.

It was not, however, until the advent of the world wide economic depression that it became widely recognised in Malaya, as it has been in neighbouring countries, that a sound, agricultural policy requires the striking of a proper balance between the production of food supplies for local consumption and the cultivation of other crops for export.

After three years of depressed prices for export crops, the moment seems opportune for reviewing the effect of this depression on the production of the staple food of Malaya.

The first article in this number of the Journal contains a general survey of the rice position in Malaya in 1933, and an outline of the developments which have occurred in recent years. Three points stand out plainly from this article, the first is that while the average production in Malaya during the period 1922 to 1930 showed only such variation from a mean of 200,000 tons per annum as was due to annual variations in climatic factors, the average production during the last three years has increased to 278,000 tons. The second is that this increase in production is due both to increase in the planted area and to increase in the average crop obtained per acre, the latter being attributable not only to

favourable conditions, but to more thorough methods of cultivation and to a wider use of the higher yielding selected strains of padi. The third point is that the fall in imports during the last three years is due not only to the reduction in population caused by the repatriation of Indian and Chinese labourers from the mines and estates, but equally to the extent to which increased production has replaced imports.

The next three articles give an account of the work which is being undertaken by the Department of Agriculture, S.S. and F.M.S., and the Departments of Agriculture in Kedah, Kelantan and Johore to increase the crop obtainable from the existing planted area in the Peninsula.

The first two of these by Dr. H. W. Jack and Mr. W. N. C. Belgrave respectively summarise the work carried out during the season 1932—33 by the officers of the Field Branch of this Department, and of the Departments in the Unfederated Malay States already mentioned, on the Padi Experiment Stations and on the Demonstration Stations and Test Plots that have been established in various parts of the different States and Settlements. All this work is carried out in accordance with the recommendations and advice of the Research Officers of this Department.

There are now within the area to which the articles refer three thoroughly well established and equipped main Padi Experiment Stations, one at Titi Serong in the Krian district of Perak, one at Pulau Gadong in Malacca and one at Telok Chengai in Kedah, while a fourth has recently been established at Kota Bahru in Kelantan. The main function of these Stations is to provide for all forms of experimental work on the selection, hybridisation, cultivation and manuring of padi.

Their subsidiary functions are the provision of supplies of seed from high yielding strains, the training of Departmental subordinates and the demonstration of proved results to the rice growing community.

The functions of each of the 30 smaller Demonstration Stations and Test Plots are threefold. Firstly to determine by exhaustive comparative trials the two or three pure strains of padi best suited to the local conditions in the area which it serves; secondly, to demonstrate to the local cultivators the increased yields and general superiority of these strains; and thirdly of providing seed supplies. On some of the rather larger Demonstration Stations it is also possible to conduct, as subsidiary lines of work, small scale experiments on certain aspects of manurial and cultivation problems and to utilise these for demonstration purposes.

The first factor to receive attention in the problem of increasing the yield from the existing area of padi land was the plant itself. The method employed was to select high yielding strains from the numerous varieties in cultivation in different parts of the country. This work has already made much progress with the result that there are now a number of such strains suitable for varying conditions of soil, water-supply and climate.

The successive establishment of the four main Experiment Stations has, however, provided increasing facilities for selecting good strains of local varieties under local conditions, with the results that there are still a number of new selections under trial and in certain areas there are indications that better yielding selections are still obtainable.

The next step in progress is to demonstrate the value of these selections and popularise them among the padi cultivators. This is the function of the numerous Demonstration Stations and Test Plots. The object aimed at is the cultivation throughout a given padi area of the fewest possible high yielding strains which will suit the local conditions. There are several advantages to such a procedure, including uniformity of growing period, evenness of ripening, and uniformity of the grain for milling in areas where there is a surplus of padi for sale.

There is now much evidence to show that the longer established Stations and Plots are already serving their purpose, in that large areas around them have been planted with a comparatively few successful selected strains demonstrated on and distributed from each of them.

The second factor in the problem of increasing the yield per acre from the existing planted area is the soil itself. Improvement in soil fertility may be brought about by manuring and also by cultivation.

In relation to manuring, results obtained in the season under review confirm the conclusion drawn by this Department from experiments extending over several years, namely that some condition or conditions exercise a limiting effect on the increase of yield obtainable from the use of manures in areas where crops are normally good. On land from which yields are abnormally low, manures will give a profitable increase in crop, but from average land the increased yield is insufficient to pay for the added cost of manures. The factors exercising this limiting effect are at present under investigation and a considerable programme of research work on this subject is in progress.

The first results of this research work are given in the paper by Mr. J. H. Dennett on pot experiments with padi in which a new method of investigating padi problems is described. The work so far undertaken has been largely of an exploratory nature to investigate the possibility of obtaining yields or responses equivalent to those obtainable under normal field conditions. That such yields and responses are obtained is amply shown in the results recorded. The method described has certain distinct advantages over field work in that it enables very detailed and continuous observations to be made on the plants and soil, while it is cheap and economical of time. Among the disadvantages will be counted the fact that tillering is below that obtained in the field. This may be due to, but is certainly balanced by closer planting as the yields show. For rapid investigation of new possibilities in manuring and methods and rates of application it should prove invaluable, as a few pots only are likely to be sufficient to show the efficacy of any such trial.

There is evidence to show that if the bar to the beneficial effect of manures could be overcome, the result might well be a noteworthy increase in the annual yield of padi per acre in many parts of the Peninsula.

Preparation of the land and methods of cultivation vary considerably in different parts of the country. In so far as they are the outcome of local experience, they may be good. On the other hand they are often laborious and elementary. The indications are that, on the whole, greater uniformity and considerable improvement are possible in these methods. Consequently experiments are in progress to test the effect of different methods, including mechanical cultivation, on the yield of crop. This aspect of yield increase is closely connected with the provision and utilisation of irrigation water which in some localities is in need of improvement and better regulation. The article on dams for small rivers by Mr. B. O. Bush is interesting in this connection.

The work described above has been carried out mainly with "wet" padi, but in Kelantan "dry" padi is a crop of considerable importance, of which the significance to the State and method of cultivation are described in the article by Mr. J. A. Craig. At the Kota Bahru Experiment Station selection, cultivation and manurial experiments are therefore being undertaken with "dry" as well as with "wet" padi.

While the type of plant, cultivation and manuring are all important factors in obtaining increased yields per acre, there remains the further method of growing two crops of padi in one year.

This method has also been investigated, both on a few Test Plots and in certain small padi areas in Selangor and Negri Sembilan. Results so far are inconclusive, because small plots are particularly subject to attacks of birds, rats and other pests when the surrounding land is not under cultivation. Success is, therefore, largely dependent on concerted action by all cultivators in each area. This is shown by the success attending the experiment in a small padi area in Selangor where all the cultivators planted two crops in one year and obtained 480 gatangs per acre of padi from them as compared with an average of 200 gantangs per acre from a single crop in previous years.

It is natural that an Agricultural Department should give attention first to increasing yields from existing areas, but the possibility of extending the planted area has not been overlooked. Since such work involves the provision of drainage and irrigation facilities it has always been conducted in co-operation with the Director of Public Works and more recently with the Adviser of Drainage and Irrigation. The latter has contributed a most interesting account of the activities of his Department during the last two years in developing new areas of padi land and exploring the possibilities of other potential areas for rice cultivation. The more important of the areas in course of development are Sungei Manik in Perak, Panchang Bedena and Tanjong Karang in the Kuala Selangor District and Sungei Blat near Kuantan in Pahang. A drainage scheme for the Tanjong Minyak and Bachang area in Malacca has very recently been

completed. These areas are all fairly adjacent to settled populations which have already taken up a considerable acreage of land in all of them and will probably continue to do so for some time. Other important developments under consideration are discussed in the article. Full development even of the areas where work is now in progress will add materially to rice production in the Peninsula. There remain, however, extensive tracts of country which are gradually being examined, in which rice production seems possible when increase of population provides the cultivators to make use of them.

With improvement in yield and increase in the planted area, it is obvious that surplus production in excess of local needs must be anticipated both in some of the new areas and in certain of the older areas which are now giving an increased production. If facilities for the ready local purchase of surplus padi are not provided, growers are liable to be discouraged and to limit their activities to the production of only sufficient padi to meet their own needs. Since transport of padi is expensive in comparison with that of rice, it is desirable that local mills of comparatively small capacity should be provided in such areas, to act both as buyers of the local crop and distributors of milled rice to surrounding villages, small towns, mines and estates. Such mills have already been erected by private enterprise in the large padi growing areas in Kedah, Province Wellesley and Penang, while the Government Rice Mill at Bagan Serai in Krian is well known. The advantage of a Government owned mill is that it can materially assist in securing a fair price for the grower. The article on Rice Milling by Dr. H. A. Tempamy and Dr. H. W. Jack shows the result of recent investigations into this question made by this Department. It discusses the situation that has to be met and the means of meeting it and further indicates that greater attention should be given in local mills to reducing the present high proportion of broken rice, if the local product is to compete successfully with imported rice.

Another article by Dr. H. W. Jack and Mr. R. B. Jagoe discusses the characteristics of locally milled rice in comparison with rice imported from Siam and Burma. It is shown that this local rice contains a high percentage of broken grains derived from mixed padis which contain kernels of unequal size, and that rice grown in Kedah shows more uniformity than rice grown elsewhere in Malaya. It is obviously important that attention should be given to grading in order to raise the quality of rice milled locally.

In connection with milling, storage of the crop is a matter of importance, since working supplies for the mill must be maintained for the twelve months following harvest in any district. In this connection Mr. W. N. Sands has contributed an interesting article on the storage of padi in Kedah.

In preceding paragraphs reference has been made to the use of Padi Test Plots as a means of propaganda in favour of the planting of high yielding types of padi. Another method of propaganda is the institution of Padi Competitions. The Malayan Agri-Horticultural Society has recently co-operated with this

Department in formulating a scheme and rules for an improved Malayan Padi Competition of which a short account is given in the article by Mr. F. W. South.

Towards the end of the number an article on the "World Rice Situation," taken from the *International Review of Agriculture*, is reproduced. An important point which emerges from this article is that the supply of rice to all countries which do not grow enough for their own needs is mainly derived from three contiguous countries, Burma, Siam and Indo-China.

It is clear in these circumstances that any causes which materially tend to reduce the supplies of rice coming from any or all of these countries is liable to have a severe repercussion on the world's rice situation, inasmuch as it will tend to cause an immediate shortage of rice and consequent distress in countries, such as Malaya, which are dependent thereon, to a marked degree, for their food supplies. Such causes may include unfavourable seasons, civil disturbances or even war.

In the years 1920—1921 this and other rice importing countries experienced a very severe demonstration of the reality of the danger in this connection, while during the Great War it was mainly the fact that the Navy enabled the transport of food to this country to be maintained which averted a similar crisis.

During the rice shortage of 1920—1921 the fact that prices for export staples were maintained at a reasonably high level enabled the situation to be faced with fair success, although, even so, the cost to the country is known to have exceeded \$40,000,000 and probably represented a very much larger sum.

If a similar condition of affairs were to arise while the existing depression continues the consequences would be far more disastrous.

In the circumstances, the existing efforts which are being made to foster the production of rice in this country constitute an obvious insurance against an ever present danger.

In the neighbouring territories of the Philippine Islands and the Netherlands India a similar policy has been in force for many years past, with the result that their dependence on imported food supplies has now become reduced to relatively small proportions; if under these conditions a solution has been provided for this pressing and important problem there seems to be grounds for believing that, provided a continuous policy of fostering rice cultivation can be assured, a similar position in Malaya may not be unattainable.

Original Articles.

RICE IN MALAYA IN 1933.

Compiled by
F. W. SOUTH,
Chief Field Officer.

In the following article a general survey is given of the position of Malaya in 1933 in relation to both imports and local production of rice. It follows the lines of the section devoted to rice in the Annual Report of the Department of Agriculture, S.S. and F.M.S., for the year 1932 and may be read as an advance section of the Annual Report for 1933.

The average wholesale prices of rice per picul in Singapore to the end of September, 1933, were as follows:—Siam rice No. 2 \$3.68, Rangoon rice No. 1 \$3.00, Saigon rice No. 1 \$3.47, while the retail prices in the three principal ports of Malaya of No. 2 Siam rice were, in cents per gantang—Singapore 26, Penang 27, Malacca 27, as compared with 30, 34 and 28 in 1932.

The price of local padi has varied according to district from 4 to 12 cents per gantang, the higher prices being confined to localities where little or no rice is grown. The average price at mill in Bagan Serai was 6.7 cents per gantang as compared with 7.5 cents per gantang during the previous year.

The net imports of rice into Malaya for the first nine months of the year show that, if imports continue at the same rate for the remaining quarter, the total net imports for 1933 will be some 10,000 tons in excess of the quantity for 1932, though their total value will be some three million dollars less owing to the fall in price. This position accords with the facts that the population of the Peninsula remained about the same as in 1932, since there was no further extensive repatriation of Chinese or Indian labourers, and that the purchasing power of the community increased slightly owing to the low price of rice and the improved prices of the two principal exports, tin and rubber. The following figures show the imports and exports of rice for the last five years:—

TABLE I.
Rice: Malayan Imports and Exports.

Year	Imports		Exports		Net Imports	
	Tons	Value \$	Tons	Value \$	Tons	Value \$
1929	785,558	95,461,036	233,897	28,031,407	551,661	67,429,629
1930	800,443	87,666,723	208,688	23,361,561	591,755	64,305,162
1931	691,112	48,458,102	175,385	13,453,189	515,727	35,004,913
1932	592,145	39,729,242	182,515	12,605,402	409,630	27,123,840
1933 (9 months)	436,686	25,239,137	120,815	7,283,977	315,871	17,955,160

Separate figures showing the imports from the principal producing countries for 1933 are not yet available.

The average declared trade value of imports of rice of all kinds into Malaya for the first three quarters of 1933 was \$57.80 per ton as compared with \$66.21 and \$67.87 in 1932 and 1931 respectively.

Malayan Production.

TABLE II.

✓ Area of Rice Land Planted in Malaya and Yield of Rice.

Year	F.M.S.		S.S.		U.M.S.		Total	
	Area	Production Rice	Area	Production Rice	Area	Production Rice	Area	Production Rice
	Acres	Tons	Acres	Tons	Acres	Tons	Acres	Tons
1929—30	174,406	48,727	67,005	25,659	415,727	77,487	657,198	151,873
1930—31	178,930	55,371	67,350	38,837	461,460	164,858	707,740	259,066
1931—32	194,580	66,517	67,980	38,959	462,420	185,489	724,980	287,322*
1932—33	214,160	74,107	70,530	35,000	482,220	182,090	766,910	291,197

(Yield estimated on a basis of 686 gantangs padi = 1 ton rice).

* Amended figure.

The figures for both acreage planted and crop harvested show a further increase on the record established in 1932 and considerably exceed the high figure of 255,000 tons for the crop obtained in 1921 as a result of the rice shortage and the low price of rubber in that year. It is of further interest to note that in the period of 3 seasons since the season 1929—30, that is the period during which the rapid fall in the price of rubber occurred, the area planted with padi in Malaya has increased by approximately 110,000 acres and the production of rice has very nearly been doubled. The increase in crop is proportionately much greater than the increase in the planted area. This is attributable in part to favourable weather conditions, but in part also to more thorough cultivation, the much wider use of pure strain seed, and greater attention to the control of pests, especially rats.

Weather conditions in the season 1932—33 were again favourable in many areas, though in others they were not so good as in the previous season. As a result the average yield of wet padi per acre in Malaya was 276 gantangs as compared with 297 gantangs per acre in 1932, though the yield of dry padi at 146 gantangs per acre showed a further improvement on the crop of 139 gantangs per acre in the previous year.

The Federated Malay States area planted increased by 19,580 acres to a total of 214,160 acres and produced a crop of 50 million gantangs of padi, over 5½ millions greater than in the previous year. These figures do not, however,

YIELDS OF PADI IN MALAYA 1922—33

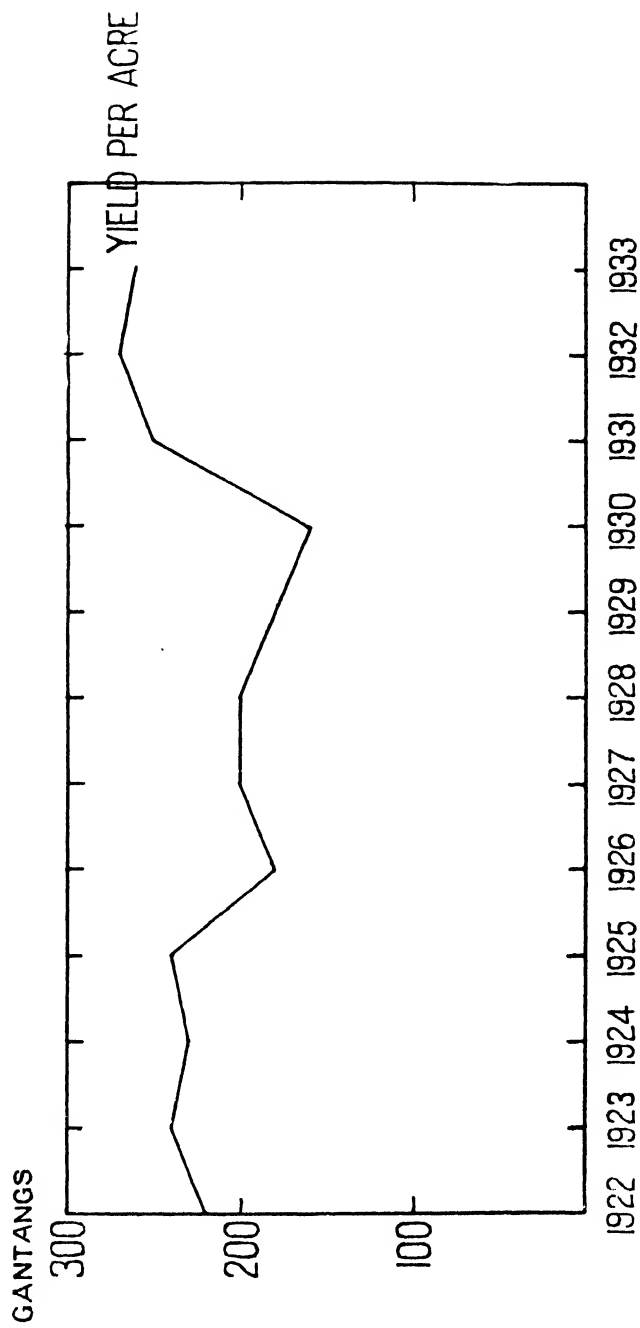
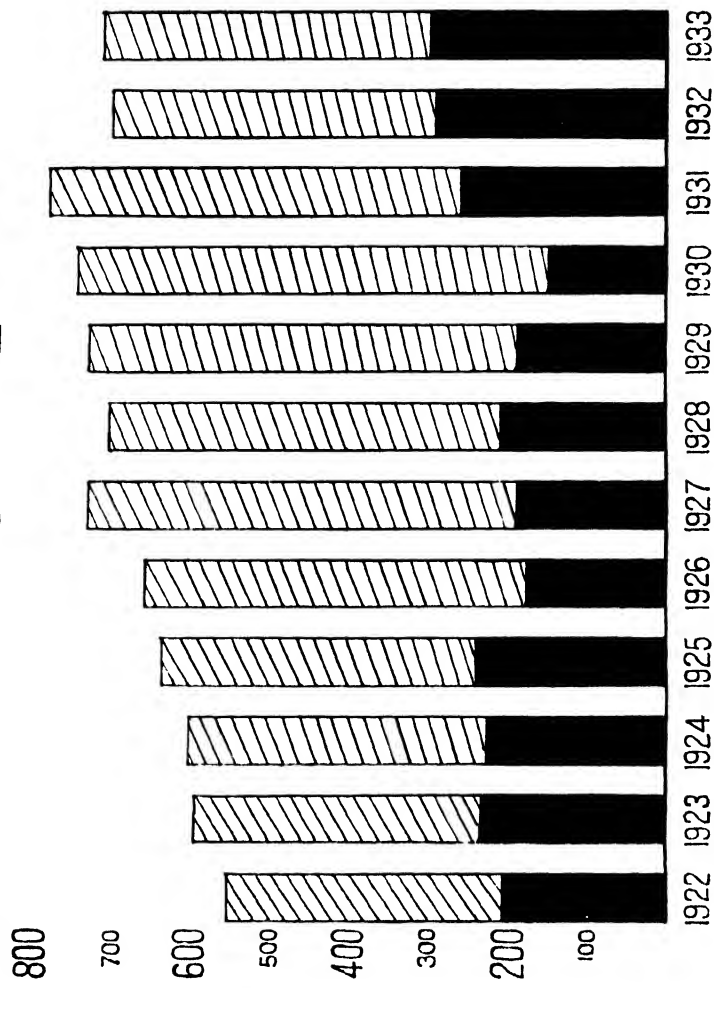


DIAGRAM SHOWING LOCAL PRODUCTION NET IMPORTS AND TOTAL
CONSUMPTION OF RICE IN MALAYA 1922—1933

PRODUCED ■ IMPORTED ▨ = CONSUMED



take into account a careful revision of the area of padi land in the Krian district of Perak which was reduced by 2,806 acres as compared with that given for 1932, to allow for the land occupied by dry crops and house sites which had previously been included in the total area planted. The agreed estimate of the crop in 1933 was 1,764,102 gantangs below that of 1932. It is considered that actually the area planted was the same in both years and that the crop of 1933 was at least as good as that of 1932, so that the real increase in the area planted and crop reaped in 1933 over those of 1932 should be approximately 22,400 acres and 7½ million gantangs respectively. The increased yield was mainly due to the increase in the planted area. The yield of wet padi per acre in the Federated Malay States was 251 gantangs as compared with 245 gantangs in the previous season and dry padi gave 139 gantangs per acre against 122 gantangs in 1932.

The area planted in the Straits Settlements increased by 2,550 acres, whilst yield decreased by 2,381,000 gantangs, mainly owing to drought early in the season in Province Wellesley North and the coastal padi lands in Malacca. Also owing to drought the wet padi crop in the Dindings was almost a complete failure.

The Unfederated Malay States showed a decrease in crop of 738,000 gantangs as compared with that of the previous season, whilst the area of land under padi increased by 19,800 acres. Gains in crop of some 4,350,000 gantangs in Kedah and Johore were offset by decreases totalling about 5,100,000 gantangs in Perlis, Kelantan and Trengganu, the biggest decrease being 3,100,000 gantangs in Trengganu which also showed a decrease of some 7,400 acres in planted area. The area of land planted with wet padi again showed an increase of approximately 25,000 acres to a total of 418,200 acres, while the dry padi area showed a further decrease of about 5,000 acres to 64,010 acres. The yield per acre of wet padi for this season was 276 gantangs per acre and of dry padi 147 gantangs per acre as compared with 294 gantangs and 144 gantangs respectively in the season 1931—32.

TABLE III.
Malayan Production of Rice in Relation to Net Imports
and Consumption, 1929-1933.

	1929	1930	1931	1932	1933
Net Imports	551,661	591,755	515,727	409,630	420,000 (Estimated)
Production (tons)	184,008	151,873	259,066	287,322	291,197
Consumption (tons)	735,669	743,628	774,793	696,952	711,197 (Estimated)
Percentage of production to net imports	34	26	50	71	70
Percentage of production to consumption	25	21	33	42	41
Percentage of 1930 net imports replaced by increased production	5.5	0	18.1	22.9	23.5

TABLE IV.
Areas and Yields of Padi for the Following Years.

Area	Total Yield Padi		Yield per Acre
1922	644,200	140,727,000	218
1923	657,380	156,411,000	238
1924	651,930	149,152,000	229
1925	656,080	159,135,000	243
1926	653,900	120,001,000	184
1927	649,690	128,374,000	198
1928	663,070	135,127,000	204
1929	687,060	126,229,000	184
1930	657,200	106,784,000	162
1931	707,740	175,867,000	248
1932	724,980	197,103,000	272
1933	766,910	199,761,000	260

TABLE V.
Area of Land Planted in Malaya and Yields of Padi, 1932-1933.

State or Territory	Wet		Dry		Total	
	Acres	Gantangs	Acres	Gantangs	Acres	Gantangs
Perak	88,620	24,330,000	18,350	2,927,000	106,970	27,257,000
Selangor	25,010	4,936,000	3,800	412,000	28,810	5,348,000
Negri Sembilan	33,930	9,948,000	460	52,000	34,390	10,000,000
Pahang	36,690	7,876,000	4,300	356,000	43,990	8,232,000
Total F.M.S.	187,250	47,090,000	26,910	3,747,000	214,160	50,837,000
Province Wellesley	32,930	10,667,000	810	195,000	33,740	10,862,000
Dindings	250	27,000	260	28,000	510	55,000
Malacca	31,940	10,925,000	—	—	31,940	10,925,000
Penang	4,340	2,168,000	—	—	4,340	2,168,000
Total S.S.	69,460	23,787,000	1,070	223,000	70,530	24,010,000
Johore	15,800	2,091,000	9,260	909,000	25,060	3,000,000
Kedah	219,010	74,366,000	6,060	1,136,000	225,070	75,502,000
Perlis	41,600	10,798,000	—	—	41,600	10,798,000
Kelantan	110,120	24,429,000	37,210	5,822,000	147,330	30,251,000
Trengganu	31,680	3,784,000	11,480	1,579,000	43,160	5,363,000
Total U.M.S.	418,210	115,468,000	64,010	9,446,000	482,220	129,914,000
Total Malaya	674,920	186,345,000	91,990	13,416,000	766,910	199,761,000

Note: Acreage to the nearest 10 acres.

Yield to the nearest 1,000 gantangs.

RICE IN MALAYA ANNUAL RATIO

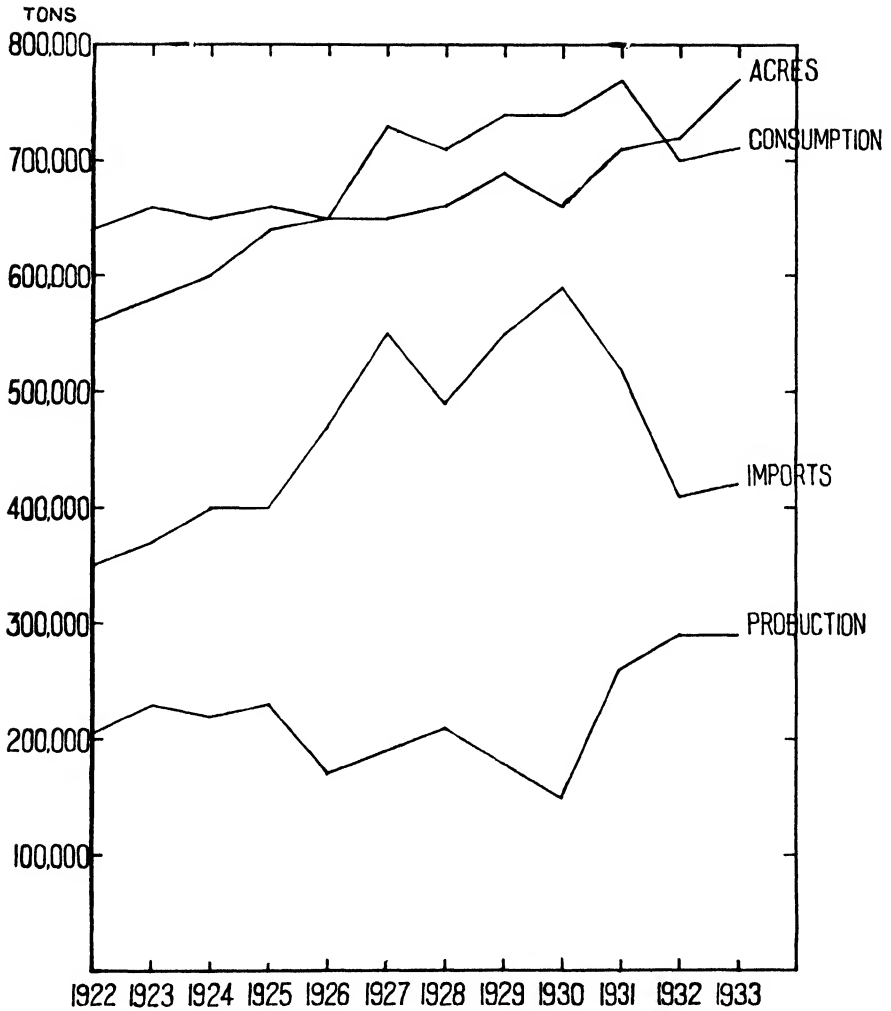


Table III above and the diagram show clearly that the decrease in imports during the last three years is due only in part to the cause previously mentioned, namely, repatriation of Indian and Chinese labourers from mines and estates.

An increasingly greater portion of this decrease is due to the replacement of imports by local production. Thus in 1933, while estimated imports will have declined by approximately 172,000 tons as compared with those in 1930, when they were highest, consumption declined by only about 32,000 tons, leaving about 140,000 tons to be provided by increased production.

Graphs showing planted acreage, production, imports and consumption of rice in Malaya during the period 1922 to 1933 inclusive, this being the period for which the figures are fairly reliable, are included in this article. It will be seen that for the 9 years 1922 to 1930 inclusive, the average local production of rice remained practically constant at 200,000 tons per annum, variations being only such as were due to annual differences in weather conditions during the padi season. This is true even of the low production in 1930 which was a year of exceptionally unfavourable weather and consequent poor harvests in Kelantan, Kedah, Province Wellesley and Krian.

Production during the last three years 1931 to 1933 has, however, shown a rapid rise to an average of 278,000 tons, the increase of 78,000 tons having replaced a like amount of imports. Although weather conditions during these years were favourable, this factor alone does not explain all the increase in production. The graph shows that there was an average increase of 85,000 acres in the planted area during these three years as compared with the average of 647,000 acres planted during the previous 9 years, while average production during the past three years was considerably higher than that of 1925 which was the highest in the preceding 9 year period.

Reference to Table IV above and to the graph giving the yields per acre during the same period, shows that in the last three years the average yield per acre has been 260 gantangs as compared with the previous highest figure of 243 gantangs in 1925. It would seem, therefore, that the rise in the yield per acre during the last three years is not attributable only to weather conditions, but is partly due to other factors such as improved cultivation and the wider use of high-yielding, pure strains of padi.

Consequently, increased production is apparently due both to an increase in the planted area and to an increased yield per acre which is only in part the result of favourable weather conditions, the balance being due to factors which would operate even in a bad season.

Crop of 1932-33.

In Krian, although damage to the spillway and drought delayed planting in the fertile, north western portion, the south eastern portion was planted up to schedule. Later in the season conditions improved and with good dry weather at harvest a good crop was obtained.

In the remainder of Perak, the inland districts of Selangor and Pahang and the whole State of Negri Sembilan good crops were reaped.

In the coastal districts of Selangor the planted area was increased by 2,493 acres owing to the opening up of new padi areas in Kuala Selangor district. The yield obtained was, however, low, since the harvest was prolonged and much damage was caused by rats and stem-borers, as is to be expected in the first few seasons on land newly cleared from jungle.

In the Pekan district of Pahang a minor flood occurred during March, shortly after transplanting. In consequence supplies of padi seeds of early maturing strains to the amount of 10,221 gantangs were obtained from Malacca and other sources and distributed. Part only of this seed was of pure strains of padi, as the supply was insufficient to meet the demand, but the balance was known to be of good quality. For the State as a whole the season proved satisfactory, since increases in planted area and crop amounting to some 9,000 acres and 2,300,000 gantangs respectively were recorded.

The yield in the Raub district of Pahang was just over 300 gantangs per acre. Yields in this district have increased by 100 gantangs per acre or 33 per cent. during a period which has coincided with the distribution of a few proved pure strains of padi from the Dong Padi Test Plot.

In the northern half of Province Wellesley drought up to the end of August adversely affected the ultimate yields. In November heavy floods were experienced in both Province Wellesley and Penang, the padi crop, however, suffered comparatively little damage.

In Malacca the coastal areas suffered from drought early in the season, but elsewhere the crop was satisfactory.

In Kedah the planted area at 225,070 acres and the crop of 75,502,000 gantangs are both believed to be the highest ever recorded for this State. This is all the more satisfactory since the area planted with wet padi was responsible for the whole increase, there being a reduction in the area planted with dry padi. The yields of both wet and dry padi per acre were high being estimated respectively at 340 and 187 gantangs per acre.

In Johore there was a satisfactory increase of some 5,000 acres in the planted area, mostly in extensions of existing areas. The crop showed an increase of somewhat over one million gantangs, but the yields per acre were comparatively low. This is probably due to the irregularity of planting dates in the State, in consequence of which a heavy toll of the crop is taken by birds and other pests.

Double Cropping.

The final result of the attempt to produce two crops in one year in the small area at Rasa in Ulu Selangor district was encouraging. The first crop planted in February gave a yield of 200 gantangs per acre in July 1932. The second crop planted in September 1932 gave a yield of 280 gantangs per acre in February 1933. Consequently the total crop of padi for the year was 480

gantangs per acre as compared with an average yield of 200 gantangs per acre in previous years. The general conclusion reached from the results obtained throughout the State is that double cropping is possible in certain areas under favourable conditions. Furthermore, it can be safely stated that, in the inland districts of Selangor, padi grows as well during the short as during the long wet season, provided that planting is so arranged that flowering does not take place in very dry weather.

A similar attempt to grow two crops in a year was made over an area of approximately 100 acres at Sri Menanti in the Kuala Pilah district of the Negri Sembilan. The land was cleared immediately after the harvest in March and planted with Radin Siak, normally a short term padi. Subsequent work on the weeding and irrigation of this crop was, however, neglected, with the result that growth was poor and much damage was sustained from the attacks of stem-borers and rats as well as of birds at harvest. The yield obtained was in consequence negligible and the whole experiment inconclusive.

Crop planted in 1933 for reaping in 1934 ✓

In Kedah, Province Wellesley, Penang and Krian, weather conditions during the present season have been on the whole favourable and good crops are expected if the weather remains normal. Prospects are also good in Malacca though drought delayed planting in the coastal padi lands. Drought also delayed planting in the riverine areas in Upper Perak and Kuala Kangsar districts of Perak, it is, however, as yet uncertain to what extent yields will be affected, since any check due to late planting may be counteracted by the more careful attention given to weeding and other cultural details.

In the Negri Sembilan and Johore crop prospects are satisfactory. In the former State rat control has not received adequate attention, while it is difficult to forecast the effect of a harvest during the wet months of November and December in Jelebu district, or the potential dangers of a long wet season and late harvest to the late planted crop in Kuala Pilah district. In Johore planting dates were again very irregular, so that part of the crop was being reaped when other areas were being planted. It is believed that the planted area has again been extended.

In Pahang the prospects for an average harvest are good, but drought has rendered planting late in some of the riverine mukims, so that the ever present danger of loss from floods has to be considered. The drought has also reduced the plantable area of most of the saucer-shaped padi fields bordering the Pahang river, with a consequent decrease in the planted acreage in this portion of the State. This decrease may, however, be offset by additions elsewhere.

In Kelantan unusually dry weather during the period July to October delayed planting and will quite possibly considerably reduce the yields of both the wet and dry padi crops.

In the inland districts of Selangor two sets of planting dates were arranged, one for double cropping and the other for a single crop to be harvested in January and February 1934.

The earlier planting dates were adopted over a considerable area, planting being commenced in March and the harvest reaped in September and October; strains of padi of short maturation period were grown. The most popular of these padis were two local varieties Aceh and Kelantan and the pure strains Nachin 27 and Radin Siak. Growth was good and satisfactory yields were obtained. Unfortunately, owing to the incidence of the Mohamedan fasting month it was not possible to plant a second crop without again placing the planting season in the wrong period of the year. The long term padis planted in other areas during August have on the whole made good growth.

In Kuala Selangor district padi planting was delayed by dry weather, but transplanting was completed by the end of November since when the young plants have made good growth. Development of the Panchang Bedena area in this district has progressed. Work on the drainage scheme has been actively continued by the Drainage and Irrigation Department and a further 150 acres of jungle have been felled and prepared for planting.

Further progress has also been made with the drainage and irrigation schemes in the Sungei Manik area in Perak and the Sungei Blat area in Kuantan district of Pahang.

During the season some 8,500 gantangs of seed of pure strains of padi were distributed from the various Padi Experiment Stations and Test Plots throughout Malaya.

During the present season a new Padi Test Plot has been opened in the Sungei Blat area of Kuantan district in Pahang and two more Padi Test Plots have been planted in Johore, one at Ayer Pupan in Endau district and one close to Segamat. Moreover the padi area in the combined Agricultural Station and Padi Test Plot at Kilanas and the Padi Test Plot at Lumapas in Brunei have also been cleared and planted.

Pests.

During the present season pests have been little in evidence. Vigorous control measures have prevented the recurrence of serious damage by rats in the newly planted Panchang Bedena padi area. In the Negri Sembilan rat destruction has not been given adequate attention by padi growers and in Johore where there is much cover near padi fields rat damage is as usual considerable.

In Krian, Province Wellesley and Malacca the systematic control measures organised under Departmental supervision have continued to prove effective and damage to nurseries or the growing crop by rats has been negligible.

PADI EXPERIMENTS IN MALAYA 1932-1933.

Selection and Varietal Trials.

BY

H. W. JACK,

Acting Chief Research Officer.

Introduction.

The padi season 1932-33 was a good one generally throughout Malaya and weather conditions being favourable, pests caused rather less damage than is usual in the main padi area. The depressed condition of the rubber industry stimulated padi planting while special efforts on the part of Agricultural and District Officers also met with considerable success.

Under existing industrial conditions padi cultivation is likely to show further advances and considerable assistance in this direction is now being given by the Department of Drainage and Irrigation with regard to water control schemes in various suitable areas. The experiments which are summarised in this paper indicate advances which have been made in investigations connected with this very important crop and they should be regarded as a continuation of similar reports published in December 1931 and 1932 in this Journal.

It must be mentioned that, although most of the experiments were devised by the Research Staff of the Department of Agriculture at Kuala Lumpur, the practical work was carried out by the Agricultural Field Officers who control the Experiment Stations and Test Plots in the various States and Settlements and to them full credit is due.

The reports of the investigations undertaken in the Unfederated Malay States are included by the courtesy of the various Governments concerned and add considerably to the value of this article.

The aim in padi selection experiments is the isolation of padi types suitable for giving the highest possible returns of grain per acre under the different environmental conditions under which padi is grown in Malaya. As a result of experience, and of definite experimental trials, it has been found that no one variety of padi is adequate for all districts but suitable selections have now been found for many areas. For the soft heavy clay areas which are abundantly supplied with water, one of the six best Seraup (Nos. 1, 15, 36, 48, 68 and 371) long maturation strains is usually found to be the most prolific. In loams and lighter soils the choice lies between Radin, Nachin and Siam types, all approximately of 6 months' maturation period. The best Radins are Nos. 2 and 4 and, in a few areas, Radin No. 7, while Nachin 10, Nachin 66 and Siam 29 have lately proved very prolific in these soils though, compared with the Seraups, especially Nachin 10, the straw is lacking in strength, and they are, in

consequence, liable to lodge in wet harvests such as are experienced from time to time in certain areas. The Seraup types, which are of excellent milling quality, originated in the Krian district of Perak and form the bulk of the crop from the northern section of that district in a normal year. In a late season in the same area Radin types are likely to predominate and they are more popular, generally, for eating than the Seraup types. All the Seraup and Radin selections have characteristically stout straw—a necessity in north Krian where the harvest is frequently marred by rains, especially if harvesting is late. The Nachin and Siam types originated in Malacca, where seed selection was inaugurated at Pulau Gadong Experiment Station with these local, popular varieties in 1925, by which time it had been ascertained, by experiment, that the Radin and other Titi Serong selections did not suit the padi growing conditions of Malacca—an important rural area.

The above mentioned selections were made by the Division of Economic Botany, the Agricultural Field Officer, Malacca, (J. Fairweather from 1921 to July 1928 and C. L. Newman from July 1928) being responsible for the field work at Pulau Gadong Station where the Siam and Nachin strains were isolated between 1925 and 1928 as potentially useful selections based on ear-to-row characteristics and mean crop-weights per plant. These selections were later confirmed by "chess board" plot tests and the latest results indicate that these strains have justified their selection. Siam 29, in particular, would appear not only to suit padi growing conditions in Malacca but in a number of other areas as well, as evidenced by results at Padi Test Plots which are now organised in most of the main padi areas. Nachin 10, while it is a good yielder in areas where dry harvest weather is the rule, will not stand up to wet harvest conditions but, in time, it is hoped that this defect may be remedied by combining its high yielding ability with strength of straw by hybridisation or by substituting Nachin 66 wherever it may be found suitable, since it has stronger straw than Nachin 10 and yields equally good crops.

During the past season the testing of various selections has, in principle, been fairly uniformly accomplished in 1/40 acre plots in randomised blocks replicated six times in the Experiment Stations and Test Plots now distributed over padi areas more or less representative of the whole of Malaya, though in a few cases the details of lay-out varied in regard to size of plots, number of strains tested and the number of replications of the blocks. The results at the various Experiment Stations and Test Plots are summarised below, yields being given in lbs. while percentages are shown to the nearest whole number.

Titi Serong Experiment Station, Krian, Perak.

Planting operations were delayed in this area by drought which was prolonged to the last week of September so that seedlings, especially the Seraups, were kept too long in the nurseries while, after the final transplanting, deep water adversely affected the young padi, particularly the early maturing strains.

Twelve late and ten early maturing strains were compared indepently in adjacent blocks in the same 'bendang' so that the mean yields of all the 22 plots are comparable.

The size of the plots in this area was 1/109 acre as usual and 84 replications adopted. The mean yields of the heavy and light types* respectively were 2370 lbs. and 1970 lbs. Both figures are low for the area, largely because grain was lost by over-ripeness, since many of the strains were too long in the field before reaping. The same types gave approximately 15 per cent. more grain in adjacent multiplication plots which were sown on the same day but reaped several days earlier. For instance, Seraup 36 gave an average yield of 2320 lbs. per acre in the trials whereas in 3 adjacent multiplication plots, this strain, sown on the same day but reaped 8 days earlier, gave an average yield of 2770 lbs. per acre. Similarly Radin 2 in the test plots, and in adjacent multiplication plots, gave yields of 1800 lbs. and 2080 lbs. respectively but the crop in the latter instance was reaped 7 days earlier than in the test plots. Seraup 36 and Radin 2 normally ripen 6 to 10 days earlier than the other strains of the same varieties, and both shatter more readily than most of the other strains so that they lose more grain in proportion, and hence they are both placed low in the tests in their respective classes in the last season. This emphasises the necessity of reaping the padi when it has reached its optimum stage of ripeness and also the need for repetition of tests, over several seasons, before final conclusions can be formed. The weather at harvest was good and rats and stem-borers did practically no damage. As regards the heavier types under trial, the tabulated results (Table 1) of the season show a low standard deviation and a significant difference of 10.1 per cent. so that Seraup 68 and Seraup 48 are definitely superior to Radin 4 and those lower in the scale. Radin 4 and Radin 7, on the season's results show better returns than Seraup 36 which is further evidence of the loss of grain which this strain must have sustained by over-ripeness since, over a long period, Seraup 36 has always given superior yields to these Radin strains.

Amongst the earlier maturing strains Radin 13 shows significant superiority over the Radin mixture and those of lesser yield, while Siam 29 is superior to Radin 16 and those below it in order of merit. Radin 2 gave low yields in this season, probably on account of its over-ripeness as already mentioned. In the same Table the best strains of both the long and the early maturing types are compared and it is shewn that Seraup 68 and Seraup 48 are superior to Seraup 1 and those of lesser yield. Seraup 36 and Radin 2 are low in order of merit and Siam 29 lodges too easily for this area but appears to be improving with acclimatisation in the past three seasons.

*Light types normally mature in less than 6½ months.

Heavy types normally require more than 6½ months to mature.

Kuala Kurau Test Plot, Krian, Perak.

At this Test Plot 9 selections were tested against a local variety in 1/40 acre plots randomised in 6 blocks and a summary of results is included in Table I. The Agricultural Field Officer, Krian, found that the control variety was Seraup 15 which has been grown widely in this vicinity for some years. The plants were rather a long time in the nurseries and, after transplanting into the fields, deep water somewhat retarded growth and tillering. Nachin 756 (F. 756) flowered earlier than the other varieties and much grain was lost due to the ravages of birds while all the plots of Siam 29 and Nachin 10 were lodged at harvest. With a significant difference of 18 per cent. Seraup 48, Seraup 36 and the control type (Seraup 15) have shown definite superiority over Nachin 10 and those below it in order of yield.

Radin 4 and Radin 2 yielded heavier crops than Nachin 10, Siam 29 and Mayang ebos 203 but not to the degree of significance though they showed definite superiority over Nachin 756 and Serendah 824, which are earlier ripening types. The results show that the long maturation types yield best in this area but good crops should be derived from Nachin 10 and Siam 29, if their straws can be strengthened by hybridization (this is under investigation). F. 756 and F. 824 are promising in years of shortage of water as they crop well and ripen early and are popular for eating, particularly the latter, and on previous experience they have been found to yield better than the local Padi Aceh which has been fairly widely used in late seasons during the past 5—6 years. Much of the padi grown in the neighbourhood of this Test Plot has been derived from previous distributions of Seraup 15 and Seraup 36 and to a lesser extent of Seraup 48, R. 4 and R. 2. In the past season Seraup 48 with a calculated mean yield per acre of 2,800 lbs. gave better but not significantly better yields than the other Seraups. The mean calculated yield for all strains was 2,212 lbs. per acre.

Selinsing Test Plot, Krian, Perak.

At this area 8 selections were compared with a local popular type in 1/40th acre plots replicated six times in randomised blocks. One selection, F. 10 (Radin Siak) was badly mixed in planting and has, in consequence, been omitted from the calculations which are summarised in Table I. The Agricultural Field Officer ascertained that the control was Radin 11 derived from previous distribution in this area. Certain unforeseen difficulties which were experienced early in the season, tended to reduce the value of the trials to some extent. The summary shows that Nachin 10 and Siam 29 are significantly better than the control (Radin 11) while Nachin 10 is definitely superior to Siam 29 and Radin 2. During the past 3—4 seasons Radin 2 has given good crops and has spread in this neighbourhood and might usefully be included in further trials before finally reaching conclusions as to its merits. The mean calculated yield in this area was 1890 lbs. per acre.

TABLE I.
Krian District of Perak.

Locality	Variety	S. 68	S. 48	R. 7	R. 4	S. Mix	S. 371	S. 6	S. 1	S. 36	S. 20	S. 146	S. 15	G.M.	S.D.	S. Diff
Titi Serong (late types)	Mean % of G.M.	24.8 114	24.7 113	23.0 105	22.5 103	22.5 103	22.3 102	21.3 98	21.2 97	21.0 96	20.2 93	19.2 88	18.9 87	21.8 100	70 3.2	22 10
	Variety	R. 13	Sm. 29	N. 10	F. 824	R. Mix	R. 16	F. 756	R. 2	F. 27	F. 875	G.M.	S.D.	S. Diff		
Titi Serong (early types)	Mean % of G.M.	22.3 123	21.0 116	20.2 112	20.0 110	19.7 108	17.2 95	17.0 94	16.5 91	16.2 90	14.7 81	18.08 100	.86 4.7	2.72 15		
	Variety	S. 68	S. 48	R. 7	R. 4	R. 13	S. 371	S. 1	S. 36	Sm. 29	S. 15	R. 2	G.Mean	S.D.	S. Diff	
Titi Serong (early & late)	Mean % of G.M.	24.8 114	24.7 114	23.0 106	22.5 104	22.3 103	22.3 103	21.2 97	21.0 97	21.0 97	18.9 88	16.5 76	21.7 100	.83 3.8	26 12	
	Variety	S. 48	S. 36	C	R. 4	R. 2	N. 10	Sm. 29	F. 203	F. 756	F. 824	G.Mean	S.D.	S. Diff		
Kuala Kurau	Mean % of G.M.	70.0 127	64.2 116	63.0 114	59.2 107	55.2 100	52.8 95	50.5 91	49.3 89	45.7 82	43.3 78	55.3 100	3.27 6	10.32 18		
	Variety	N. 10	Sm. 29	R. 2	C	F. 824	F. 8	R. 4	N. 27	G.M.	S.D.	S. Diff				
Selinsing	Mean % of G.M.	59.2 125	51.8 110	47.2 100	47.0 99	46.7 99	44.7 95	42.3 90	38.7 82	47.2 100	22.1 5	4.92 10				
	Variety	Sm. 29	F. 203	F. 824	N. 10	R. 2	C	S. 48	R. 4	N. 27	F. 10	G.M.	S.D.	S. Diff		
Briah	Mean % of G.M.	65.7 135	58.2 120	53.1 109	52.3 108	52.1 107	50.8 105	47.8 99	45.3 93	30.2 62	29.6 60	48.5 100	1.96 4	5.94 12		
	Variety	Sm. 29	F. 203	F. 824	N. 10	R. 2	C	S. 48	R. 4	N. 27	F. 10	G.M.	S.D.	S. Diff		

Briah Test Plot, Krian, Perak.

A local popular type was tested against 9 selected strains at this Test Plot in 1/40 acre plots replicated 9 times in randomised blocks. The Agricultural Field Officer, Krian, discovered that the control type was Serendah 875 derived from previous distributions of padi seed in this area. A summary of the results is shown in Table I. One plot of Siam 29 which was situated on a previous house site, gave a yield of 99 lbs. which had the effect of raising the average yield per plot for this strain by 4 lbs., thus rather exaggerating its productive capacity and making it appear significantly superior to all other varieties in the comparison. However, even with a corrected yield of 128 per cent. (compared with the mean yield) it is superior to all but Mayang ebos 203 which is itself superior to the control type. Several ant hills had to be removed from this area and Radin Siak 10 was unfortunate in being planted in most of the plots which had to be treated in this respect, with a consequent diminution in its plot yields, moreover this selection and Nachin 27 ripened earlier than the other, were somewhat over-ripe and were detrimentally affected by birds. The yields are good for this area, the mean calculated crop being 1940 lbs. of clean padi.

Lenggong Test Station, Lenggong, Perak.

Several plots in this Station suffered from floods which were experienced four times and were most severe in the Seraup plots causing a fair amount of lodging amongst these strains. The early maturing types, although they were not so fully exposed to the floods, suffered more severely therefrom. However, despite the floods, and slight damage by birds and sucking bugs, good crops were reaped on this area, the calculated general mean yield for Seraup being 3780 lbs. per acre and for the lighter types 3390 lbs. The good growth conditions necessitated two weedings of the early planted Seraups and it is noticeable that all these types ripened within a period of 7½ months from the date of sowing. Three Seraup selections were compared with a local Seraup type in 1/40 acre plots replicated 10 times in randomised blocks, while six early maturing types were tested against a local Radin variety in plots of similar size replicated 6 times in randomised blocks. The results are given in Table II which shows that Seraup 36 is significantly better than the local Seraup, while Seraup 15 and Seraup 1 gave higher yields than the control but not to the degree of significance. This result confirms the trials of the previous two seasons and there is no doubt regarding the yielding ability of Seraup 36 and Seraup 15 in this locality, while Seraup 1 has also given useful yields each season compared with the local varieties. Of the earlier ripening types Mayang ebos Nos. 202 and 208 and Siam 29 gave significantly heavier yields than the local Radin variety which was also considerably exceeded in yield by Radin 2 and Radin 4 though not to a significant extent. As far as R. 2, R. 4 and Siam 29 are concerned this result

confirms those of the previous 2 years, while Mayang ebos 202 and 208 are distinctly promising in their first test at this area, with yields little short of Seraup 36.

Nachin 10, though potentially a heavy yielder, failed owing to its weak straw and should be eliminated.

Talang Test Station, Kuala Kangsar, Perak.

The weather conditions appear to have been good in this area in the past season, as the general mean yield from the varietal trials was 3130 lbs. per acre, despite slight attacks of stem-borers and grain sucking bugs. Nine selections were tested against a local Radin type in randomised 1/40 acre plots quadruplicated in blocks; a summary of the results is included in Table II in which it is apparent that the local Radin type failed signally in comparison with all the selections. The significant difference between means is high but still Siam 29 gave excellent and significantly better crops than Radin 2 and those of lesser yield. Nachin 756 and Serendah 824 gave surprising yields in comparison with Radin 2, which over several years has given the best yields, and with Radin 4 which gave the highest yield in 1930—1931 and was little behind Radin 2 in the 1931—1932 season. This result, coupled with the low yields of Radin 4 and Radin 2, indicates that the season may have been abnormal in some respect and, therefore, too much reliance should not be placed on the results for the present. Siam 29 certainly appears to be very prolific and promising in the locality, while Nachin 756 may be useful for its early maturity and good straw, its calculated mean yield per acre being 3720 lbs.

Bukit Gantang Test Plot, Perak.

This area suffered from water shortage on three occasions during the growing period of the padi, owing to the collapse of the dam, while rats caused slight damage in patches, nevertheless the general average yield of 2472 lbs. per acre was quite good. Eight selections were tested against a local Radin type in 1/40 acre plots quadruplicated in randomised blocks and a summary of the results is included in Table II. The best crops were derived from Radin Nos. 7, 2 and 4 and Nachin 22 but, although the yields of these strains were considerably better than that of the control, no significance was portrayed in the results. The vagaries of the water supply undoubtedly rendered the results unreliable in the past season and caused a fair amount of lodging, Nachin 22 being the worst in this respect. Nachin 27 stood up excellently but as it ripened earlier than any of the other selections it probably suffered more from the water shortage which occurred just before flowering. The inclusion of a few types with stronger straw appears to be indicated in this area in further trials, care being taken to plant the various lots so as to synchronise harvesting dates as nearly as possible.

TABLE II.
Perak (Excluding Krian District).

[illegible]

Bruas Test Plot, Kuala Kangsar, Perak.

This area suffered from its newness as many of the plots were uneven, resulting in different water levels within many of the plots so that the padi ripened unevenly. In addition, several plots were so severely affected by the presence of holes and tree stumps as to influence the results materially. This defect applied particularly to Radin 4 and Nachin 27 since, with each of these strains, 3 plots produced only about half of their potential yields which, in the case of R. 4, reduced the average yield for the variety from a potential value of 65–70 lbs. to 44 lbs. per plot, while, with Nachin 27, the potential value was reduced from 50–55 lbs. to 36.5 lbs. Seraup 36 was similarly affected but not so materially as R. 4 and N. 27. The results summarised in Table II, show too high a standard deviation, but Seraup 1 produced a significantly better crop than the local Seraup control while Seraup 15 and Seraup 36 gave considerably heavier crops than the control but not to a significant degree. The local Radin control, which on examination appeared to be Radu 13 acclimatised from previous distributions, yielded more heavily than any of the light padi selections.

Attention should be directed towards avoiding patches which contain logs or holes and such defects should, if finances permit, be removed.

Dong Test Plot, Raub, Pahang.

Conditions appeared to have been normal during the past season in this area, since good average crops were reaped, the general calculated mean yield for the Station being 2840 lbs. of padi per acre. Eleven selections were tested against a local popular but mixed type (Jambak bawang) in 1/40 acre plots replicated 6 times in randomised blocks, but two selections, Serendah 12 and Nachin 27, which ripened much earlier than the rest, were destroyed by birds and have, in consequence, been omitted from the calculations. The results are summarised in Table III and show that 7 of the selections proved superior in yield to the control type. Siam 29, though inclined to lodge, produced the highest crop and was significantly better than Radin 4 and those below it in yield, while Nachin 10 gave a better crop than Seraup 36 but is disliked because of its weak straw and should be replaced by the stouter strawed Nachin 66, which practically equals it in yield. Radin 13, which in several previous seasons gave such good yields at this Station, gave a better crop, but not to the extent of significance, than the other Radin strains but was outyielded by Siam 29 and Nachin 10. It may be mentioned that Seraup 36 and Radin 13 have already spread considerably in the neighbourhood of this Station. In trials next season care should be taken to plant all selections so that they will mature approximately at the same time.

Kendong Test Plot, Rembau, Negri Sembilan.

In this area eleven selections were planted for testing against a local popular type which appeared to be a mixture of Serendah 875 from previous distribu-

tions with a local Serendah kuning. Three of the selections, Radin Siak 10, Nachin 27 and Nachin 756, which ripened in advance of the general crop, were practically destroyed by the ravages of birds and rats and, in consequence, these strains have been omitted from the calculations. In a few plots soil conditions were poor and some plots were damaged by floods, irregular water supplies and pests in the early stages of growth, while rats and birds accounted for a fair amount of loss grain in a number of plots. However, despite these defects, the general mean crop was 1920 lbs. which is quite a fair return for this area under the conditions during last season. A summary of the results, given in Table III, shows too high a standard deviation but still the control type (mixed Serendah 875) was significantly better than Siam 29 and those of lesser yield, while Seraup 36 and Serendah 11 were the next best yielders. Siam 29 was lodged in a few patches at harvest with consequent slight loss of grain. Nachin 10 suffered severely in this respect. Selections for this area for next season should include Serendah 875, Nachin 66, Siam 29, Seraup 36, Radin 2, Radin 13, Mayang ebos 203, Nachin 756 and Radin Siak 17. Again it is necessary to stress the need for arranging planting so as to secure synchronisation of harvest for all lots, as nearly as possible.

Kuang Test Plot, Selangor.

With a view to growing two crops a year (at the suggestion of local cultivators) a change in season led to the sowing of nurseries in the hot months of February and March with subsequent heavy infestation of stem-borers. The young padi, after transplanting into the fields was again so severely damaged by these borers that it failed to recover vigour in time to produce satisfactory crops.

Six selections, planted in randomised plots, replicated nine times, included Serendah Nos. 741, 824 and 875, Nachin 27, Nachin 756 and Radin Siak 10, but the Serendah strains, owing to maturing later under local conditions, were completely destroyed by rats and birds, although growth was good and crops were promising. The other 3 strains suffered from drought at flowering time, in addition to stem-borers, so that they gave very low yields averaging 1,040 lbs. per acre, Nachin 756 being the best with 1130 lbs. per acre and receiving favourable comment by the cultivators. Under the adverse conditions which prevailed a high standard deviation (9.3 per cent.) was to be expected so that no significance is shown nor can reliance be placed on the results given in Table III.

Kajang Test Plot, Kajang, Selangor.

In this area four early maturing selections, Nachin 27, Nachin 756, Serendah 824 and Radin Siak were compared in 1/40 acre plots replicated 7 times. The growth of all the selections was good, water being sufficient and little damage being wrought by pests. The Serendah 824 ripened later than the rest and

suffered from lack of water too soon, due to drainage while the other selections were maturing.

Nachin 27 with a calculated mean yield of 1970 lbs. per acre was superior to the remaining selections, while Nachin 756 is distinctly promising but the Radin Siak proved a failure under existing conditions. Nachin 27 has given satisfactory crops in this area for several seasons and is spreading in the district.

Temerloh Test Plot, Pahang.

At this Test Plot the formation of the 'paya' is not amenable to water control so that the padi is always liable to suffer from floods or drought. With random distribution of plots within a sufficient number of well disposed blocks the effects of local conditions became fairly well averaged for all varieties included in the tests, nevertheless, more satisfactory crops and more reliable results might be obtained should it be found practicable to divide the area by suitably placed 'batas' into level blocks for water control purposes. In the last season a comparison between the local popular type, Seri ayer, and 7 selections was made in 1/40 acre plots replicated 9 times in randomised blocks. One selection, Nachin 27, which was promising in appearance, ripened considerably in advance of the local padi and was, in consequence, entirely destroyed by birds and this strain has, therefore, been omitted from the calculations which are summarised in Table III. The results show that Serendah 875 is, for all practical purposes, significantly superior to the local control type, despite a very high standard deviation. The local control showed superiority over Radin 4 and Radin 7, these 3 types taking 9 months to mature as compared with 6 $\frac{3}{4}$ months for Serendah 875.

Serendah 875 and Radin 13 have already spread considerably in Pahang East.

Pekan Test Plot, Pekan, Pahang.

At this area 5 selections were compared with the local popular padi Mileh puteh in 1/40 acre plots replicated 6 times in randomised blocks. A few plots suffered from lack of water but a fair calculated mean yield of 1360 lbs. per acre was harvested. No positive significance has been found in the results which are shown in Table III, but Radin 13 (8 months) Radin 2 (7 months) and Nachin 27 (6 months) produced crops considerably in excess of the local padi Mileh which was lodged at harvest and required 8 $\frac{1}{2}$ months to mature. Radin Siak 10 which matured in 6 months also outyielded the local type, while Serendah 875 (6 months) almost equalled it.

In local multiplication plots, Serendah 875 gave good yields, reaching 2170 lbs. per acre at Temai and 1520 lbs. per acre at P. Rusa. This padi has spread in certain areas in the Pekan district, although it did not show up well in the Test Plots last season.

TABLE III.

Dong Test Station, Raub — Pahang.

Variety	Sm. 29	N. 10	R. 13	R. 4	R. 2	Sr. 875	S. 36	M. 210	P. P. I.	Cont.	G. M.	S. Diff.
Plot M. % of G. M.	89.3 125	83.3 117	76 107	71.2 100	70.7 99	69.5 98	68.2 96	65.3 92	61.8 87	54.5 77	71.1 100	13.3 19

Kendong Test Plot — Rembau — Negri Sembilan.

Variety	Cont	S. 36	Sr. 11	Sm. 29	N. 10	R. 13	R. 28	M. 206	R. 2	G. M.	S. D.	S. Diff.
Plot M. % of G. M.	66 135	54 112	54 112	48.5 101	46 96	43 91	41 83	41 83	39.5 82	48.1 100	4.37 9	13.7 28

Kuang Test Plot — Kuang — Selangor.

Variety	N. 756	R. S. 10	N. 27	G. M.	S. D.	S. Diff.
Plot M. % of G. M.	28.3 109	26.8 103	22.9 88	26.0 100	2.41 9	7.2 28

(contd.) Temerloh Test Plot — Temerloh — Pahang.

Variety	sm. 875	Local	S. 36	R. 13	R. 2	R. 4	R. 7	G.M.	S.D.	S. Diff.
Plot M. % of G.M.	57.8 142	47.7 117	43.4 107	41.7 102	39.2 96	27.5 67	27.5 67	40.7 100	3.6 9	10.6 26

Pekan Test Plot — Pekan — Pahang.

Variety	R. 13	R. 2	N. 27	R.S. 10	Contl.	F. 875	G.M.	S.D.	S. Diff.
Plot M. % of G.M.	38.5 113	38.0 112	35.3 104	32.3 95	30.2 89	29.3 86	33.9 100	3.2 9	10.3 30

S. = Seraup, M. = Mayang ebos, R. = Radin.

Sm. = Siam, R.S. = Radin Siak, N. = Nachin, Sr. = Serendah,

Bukit Merah Test Station, Butterworth.

A calculated general mean yield of 1940 lbs. per acre from the Test Plots in this area indicates that the last season was only a fair one. Insects, particularly 'bena' (*Nephotettix bipunctata*) wrought a variable amount of damage especially in the Seraup and Santap plots which also suffered considerably from drought. Stem-borers were also conspicuous and decreased the crops slightly.

Nachin 10 and Siam 29 became badly lodged at harvest but in the dry weather gave good returns.

Eleven selections were tested against the local popular Mayang ebos; the results given in Table IV show that this control variety outyielded all the selections and was significantly better than the selected Mayang ebos 205 and those of lesser yield.

Nachin 756 gave the next highest crop and was closely followed by Siam 29 and Nachin 10.

Seraup 15, in the previous season, gave the best crop in these Test Plots and, with Nachin 10, outyielded the local Mayang ebos though there was little difference between their crops. The Seraups undoubtedly suffered severely from adverse conditions in last season. Mayang ebos 203 and Serendah 824, which both showed promise in the previous season, were omitted from the tests. In next season pure line selection should be inaugurated with the local variety Mayang ebos since it has proved a reliable and heavy cropper in the past 3 seasons and is popular for eating.

Glugor Test Plot, Penang.

This Test Plot suffered a good deal from flood and from borers, so that crops were only fair for the district, the calculated general mean yield being 1,900 lbs. per acre. Ten selections were compared with a local acclimatised type but the early-ripening strains, Radin Siak 10 and Nachin 27, were so severely damaged by flood that they have been omitted from the calculations. The control type was found to be Seraup 15 derived from former distributions in the neighbourhood. The tests were carried out in 1/40 acre plots in randomised blocks replicated 6 times and the results are summarised in Table IV which shows definitely that the Seraup strains (including the control, S. 15) were significantly better yielders in this area than the lighter types of padi under the conditions which prevailed during the season. The same strains were significantly better than the control in season 1930-31 when they were closely followed by Radin 4, as in the season under review. (In season 1931-32 the crop was destroyed by rats). Most of the earlier ripening types were too long in the fields and probably suffered from over-ripeness; Nachin 756 and Siam 29 gave the best crops and were closely followed by Nachin 10 and Radin 2. In the next season, the Seraup types might be tested independently of the earlier maturing types, care being taken that planting is arranged so that all strains can be harvested about the same time.

TABLE IV.
Province Wellesley and Penang.

Bukit Merah Test Station.

Variety	Contl.	N. 756	SM. 29	N. 10	M. 205	N. 27	SM. 63	R. 13
Plot M. % of G.M.	60.0 124	57.0 118	55.5 115	54.0 112	50.3 104	49.8 103	48.6 100	46.5 96
Variety	R. 2	S. 36	S. 15	F. 39	G.M.	S.D.	S. Diff.	
Plot M. % of G.M.	43.8 90	40.6 84	38.6 80	36.5 75	48.4 100	2.6 5	8.0 17	

Glugor Test Plot

Variety	Contl.	S. 36	S. 15	R. 4	N. 756	SM. 29	N. 10	R. 2
Plot M. % of G.M.	64.1 135	63.6 134	62.8 132	45.3 95	42.8 90	41.3 87	39.3 83	38.5 81
Variety	R. 13	G.M.	S.D.	S. Diff.	S. = Seraup, M. = Mayang ebos, SM. = Siam, R. = Radin, N. = Nachin, F.39 = Santap.			
Plot M. % of G.M.	31.0 65	47.6 100	3.8 8	12.1 25				

Sungei Tontong Test Station, Dindings.

This Test Station was inaugurated last season and the land was laid out to compare 7 selections with a local popular type (Sri panji) in 1/40 acre plots in randomised blocks with six replications. The nurseries, however, were sown so late that weather conditions did not harmonise with planting operations and the padi suffered severely from drought at flowering time and from rain, rats and birds during the harvest. In consequence very small crops were reaped and the results obtained are of no value except to indicate that Siam 29, Serendah 824 and Radin Siak 10 withstood the prevalent conditions better than the other selections. The dates of planting operations should be advanced considerably next season when trials should be arranged so as to synchronise harvesting as much as possible.

Pulau Gadong Experiment Station, Malacca.

At this Experiment Station tests were carried out with three varieties, Siam, Nachin and Radin Siak, in plots of 100 square feet (100 plants) replicated five times in randomised blocks. With regard to the Siam variety the calculated mean yield per acre was 2,530 lbs. and Siam 29 again gave significantly better results than the remaining strains which did not prove better than local unselected padi Siam. The five Nachin strains produced a calculated mean yield of 2,420 lbs. per acre but no significance was evident in the results, which show that N. 66 and N. 11 gave slightly higher returns than N. 10 to which they are superior in straw strength. Eight Radin Siak selections were compared with the local unselected seed to which 7 of the selections proved definitely superior, though the unselected plots were damaged by rats to some extent. The Radin Siak types ripen very early and may prove very useful in areas where short wet seasons are experienced. The results are summarised in Table V in which yields are given in 1/10 lbs. per plot for Siam and Nachin selections but for the Radin Siak types yields are given in 100's of grammes per plot.

Numerous multiplication plots at this Station gave excellent measured yields at harvest, amongst which mention may be made of Siam 76 (2,800 lbs. per acre) Nachin 66 (2,900 lbs. per acre) Melek puteh 2 (2,400 lbs.) Melek kuning 3 (2,300 lbs.) Serendah 824 (2,300 lbs.) Nachin 27 (2,150 lbs.) and Radin 11 (1,800 lbs.). A considerable amount of seed distribution has taken place, not only in Malacca but to other States where Siam 29 has been proved of value.

Telok Chengal Experiment Station, Alor Star, Kedah.

At this Experiment Station pedigree line selection, which has been in operation for the last two years, shows promise of valuable results with 7 local popular varieties but further tests are necessary before the best selections can be determined. The local varieties are Riong, Radin Che Nah, Radin China,

TABLE V.

Variety	Sm. 29	Sm. 18	Sm. 76	Sm. 72	Local	M.	S.D.	S. Diff.
Mean % of G.M.	10.08 120	8.24 98	8.12 97	7.96 95	7.54 90	8.38 100	.28 3.4	.93 11
Variety	N. 66	N. 11	N. 10	N. 70	Local	M.	S.D.	S. Diff.
Mean % of G.M.	8.38 104	8.28 103	8.12 101	7.66 95	7.66 95	8.02 100	.24 3	.78 10
Variety	R.S. 18	R.S. 17	R.S. 7	R.S. 69	R.S. 9	R. S. 24	R.S. 25	R.S. 100
Mean % of G.M.	36.6 112	36.4 111	36.2 110	35.6 109	34.8 106	34.8 106	32.0 98	26.6 81
Variety	R.S. Local		G. Mean		S.D.	S. Diff.		
Mean % of G.M.	22.2 68		32.8 100		1.5 4	4.8 15		

Mayang ebos, Kunchor, Chubai and Chempah puteh and, so far, the first four show greatest promise. Good crops were harvested from various selections grown in single multiplication plots varying in area from half an acre up to 3 acres at this Station and the Table below shows the calculated average yields obtained, the mean yield for all the selections being 2,530 lbs. per acre.

Selection	Grain per acre	Selection	Grain per acre
Riong 6	3,160 lbs.	Radin 2	2,360 lbs.
Radin Che Nah	3,090 "	Radin 7	2,360 "
Serendah 824	2,860 "	Mayang ebos	2,280 "
Radin China	2,760 "	Seraup 15	2,230 "
Nachin 10	2,650 "	Radin 13	2,220 "
Siam 29	2,570 "	Seraup 36	2,210 "
Nachin 27	2,480 "	Radin 4	2,170 "

Where the selection number is omitted, the seed used consisted of a mixture of 2 or more selections of the variety named.

Varietal tests were carried out in this State at four Test Plots situated in the main padi areas of the State. At each area the tests were conducted in 1/45 acre plots replicated 6 times in randomised blocks. The results, summarised in Table VI indicate that Seraup selections give increased yields in the deep soft soil areas, while Siam 29 and Nachin 10 give excellent crops in the typical hard soil areas and, though both these strains suffer from lodging, good crops are reaped since harvest weather in Kedah is usually dry.

Sala Kanan Test Plot.

This plot is representative of the deep, softer soils found in parts of Kedah ("gelam" land) and comparisons were made between three Seraup selections and two local popular types, Mayang ebos puteh and Seri raja. Growth was fairly good, the calculated mean yield per acre being 2,210 lbs. but a few plots suffered somewhat from stem-borers and deep water. The summary of results given in Table VI shows that Seraup 48 gave significantly better crops than the controls. In the previous season, Seraup 15, Seraup 36, and Radin 7 gave better crops than the controls but Radin 7 was omitted last season because its rice is unpopular for eating.

Rantau Panjang Test Plot.

In this area 3 selections were tested against 3 local popular types, (Anak kuching, Ibu kuching and Riong) under fair conditions and produced a mean calculated crop of 2,220 lbs. per acre. The summarised results in Table VI show that Siam 29 gave significantly better crops than two of the control types and was considerably better than the third control, (Anak kuching) while Nachin 10 was almost equal in yield to Siam 29.

Langgar Test Plot.

Three selections were compared with 3 local popular types, (Melor, 'Toh Seman and Radin puteh) in this area and the results (Table VI) confirmed those of the previous season in that Nachin 10 proved significantly better than any of the controls.

Soil conditions being apparently somewhat poor, the calculated mean yield per acre, 1,730 lbs., was low and eel-worms were destructive in patches, especially to the Radin selections, which appeared to suffer severely from this pest. Possibly earlier ripening types might be more suitable in this area and Radin Siak 17, Nachin 756, Siam 29, Nachin 10, Nachin 66, Radin 2 and the local padi Melor might usefully be tested next season.

Jitra Test Plot.

Stem-borers and fresh water crabs damaged the crops at this Plot, vitiating the results, but growth was good and a fair mean crop calculated at 2,065 lbs. per acre was harvested.

The results (Table VI) show too high a significant difference between means and no significance is revealed. Two local types, Mayang batil and Radin Siam, produced the highest crops, while Radin 13 and Radin 4 were favourably commented on by the cultivators. In the previous season Nachin 10 gave significantly superior crops in this area but was omitted in last season's tests.

TABLE VI.

Kedah Test Plots.

Locality	Variety	S. 48	S. 15	S. 36	ME. P	S.R.	G.M.	S.D.	S. Diff.
Sala Kanan	Plot M. % of G.M.	54.0 110	49.3 100	47.8 97	47.5 97	47.5 97	49.2 100	2.0 4	6.2 13
Rantau Panjang	Variety	Sm. 29	N. 10	A.K.	I.K.	Riong	R. 2	G.M.	S. Diff.
	Plot M. % of G.M.	58.5 118	57.2 116	51.3 104	49.2 100	42.5 86	37.7 76	49.4 100	8.34 17
Langgar	Variety	N. 10	Mel.	Tok. S.	R. Put.	R. 2	R. 13	G.M.	S. Diff.
	Plot M. % of G.M.	46.3 120	40.8 106	37.5 97	37.0 97	36.5 76	32.8 85	38.5 100	3.56 9
Jitra	Variety	M. Bat.	R.S.	R. 13	R. 4	R. Put.	R. 2	G.M.	S. Diff.
	Plot M. % of G.M.	51.2 111	49.2 107	45.6 99	45.0 98	43.2 94	41.6 90	45.9 100	14 30

Pasir Puteh Test Station—Pasir Puteh, Kelantan.

In this Station 7 wet padi selections were compared with 9 local popular types in 1/220 acre plots replicated 7 times in randomised blocks.

Judging by the general mean crop of 1,540 lbs. of clean padi per acre, the past season was a fairly representative one for the district though possibly the dry weather set in a trifle too soon and thus slightly lessened the crops, but, with so many types under comparison, the general mean yield is satisfactory.

The results are shown below in the order of mean yields per plot in lbs. and in percentages compared with the general mean yield (7.0 lbs.)

TABLE VII.

Variety	Sm. 29	N. 10	R. 13	A.J.T.	R. 4	Manik	P. Treng	Sr. 824	N. 27
M. of Plots % of G.M.	9.0 128	8.5 126	7.7 109	7.5 107	7.45 106	7.45 106	7.45 106	7.15 102	6.95 99
Variety	P.P.	Raub	A.I.S.	Chatche	Nalun	R. 2	Serdh.	G. Mean	S. Diff.
M. of Plots % of G.M.	6.55 93	6.4 91	6.37 91	6.3 90	5.9 84	5.85 84	5.5 78	7.0 100	1.35 19

The results indicate that the selections Siam 29 and Nachin 10 are significantly better yielders than any of the local types while selections R. 13 and R. 4 have shown good yields compared with the next local types (A. I. Tinggi, Manik and P. Trengganu).

Kota Bahru Test Station—Kota Bahru, Kelantan.

In this area a comparison was carried out with local popular types of dry padi and one wet padi selection (Radin 2) in plots of 1/220 acre replicated eleven times in randomised blocks. The results are summarised in the following Table in which yields are given in lbs. per acre.

TABLE VIII.

Variety	Jentan koring	Sabumi puteh	Jentan manis	Muar padok	Kaki merpati	Muar pandan	Anak lebak
Mean % of G.M.	1,960 123	1,920 121	1,850 117	1,730 109	1,700 107	1,520 96	1,510 95
Variety	Nurium	Kedah	R. 2	G. Mean	S.D.	S. Diff.	
Mean % of G.M.	1,380 87	1,330 84	1,010 64	1,590 100	83 5.2	245 15	

The results indicate good average crops for dry padi in this area and that conditions did not favour the wet padi type—Radin 2. Padi Jentan koring, Sabumi puteh and Muar padok show definite superiority over padi Muar pandan and those below it in order of merit. Padi Nurium and Kedah mature some-

what earlier than the others under trial and gave proportionately quite fair crops. Tests of the better types will be repeated next season.

It might be mentioned that good crops were reaped from several selected types grown in numerous plots scattered over the wet padi areas of Kelantan, the most promising selections being Radin 2, Siam 29, Nachin 66, Mayang 210 for the lighter soil areas and Seraup 15, Seraup 36 and Seraup 48 in the heavy deep soils.

Johore.

Varietal trials of selected strains of padi were inaugurated in Johore along standardised lines in the past season. As no financial provision had been made for these trials and as it was already a trifle late before a commencement was made, it was necessary to depend on Penghulus and others interested in the cultivation of padi, for assistance in the matter of land and supervision. Six centres were selected as representative areas and, in every case, land and all labour were provided free by the Penghulu or cultivator concerned, incidentals alone, amounting to \$25 to \$30 at each centre, having to be paid for by the Department of Agriculture. The local demand is for padi of not more than six months' maturation period and the following strains were selected for the first year's trials, seed being supplied from Pulau Gadong Padi Experiment Station in Malacca:—Siam 29, Siam 19, Nachin 10, Nachin 11, Nachin 66, Nachin 27. Two local popular types were used in each case as control varieties.

At each centre the lay-out consisted of randomised blocks replicated six times, each block containing all the varieties in the comparison, planted in 1/80 acre plots. All the Nachin 27 plots matured considerably in advance of the other strains and in consequence this strain has been omitted in calculating the results since, in every case, the crop was so severely damaged by pests that it was hardly worth reaping. Table IX gives a summary of the results treated statistically, yields being shown in pounds of cleaned padi while percentages are given to the nearest whole number.

Labis Test Plots.

These Test Plots are situated 3 miles from the main road in the main padi area of Labis although they are only accessible by a jungle path. The yields per acre show that the soil conditions are very good and water supply was abundant and controllable. The results show that Siam 29 and Nachin 11 (for practical purposes) are significantly better than both the local control varieties. All the strains under trial were lodged in varying degrees but the rayats were favourably impressed with the results. For next season Nachin 66 and Siam 18 and the local Serendah puteh might be replaced by Radin 2, F. 27 (planted to ensure maturity at the same time as the other lots) and Seraup 48—three strong strawed types, and Mayang ebos 201 might be added, if practicable, in the area available.

TABLE IX.

	Variety	Sm. 29	N. 11	Sm. 18	N. 10	N. 66	S. Kun.	S. Put.	G.M.	S.D.	S. Diff.
Labis	Mean	46.1	45.3	41.8	39.5	38.5	38.5	36.6	40.9	2.26	7.1
	M. per ac. % of M.	3688 113	3624 111	3344 102	3160 97	3080 94	3080 94	2928 89	3272 100	181 5.5	568 17
Pulau Penari	Variety	N. 11	S. 29	Sultan	N. 66	S. 18	N. 10	S. Kamp	Mean	S.D.	S. Diff.
	Mean	40.5	40.1	39.5	39.3	38.5	37.8	30.8	38.0	1.86	5.86
	M. per ac. % of M.	3240 107	3208 105	3160 104	3144 103	3080 101	3024 99	2464 81	3040 100	149 4.9	469 15
Tangkak	Variety	S. 29	Sultan	N. 66	S. Kamp	S. 18	N. 11	N. 10	Mean	S.D.	S. Diff.
	Mean	42.0	35.5	33.6	32.8	30.6	28.6	26.5	32.8	2.36	7.44
	M. per ac. % of M.	3260 128	2840 108	2688 102	2624 100	2448 93	2288 87	2120 81	2624 100	189 7.2	595 23
Sungei Balang	Variety	S. 29	N. 10	N. 11	N. 66	B. Ber.	Peteh	S. 18	Mean	S.D.	S. Diff.
	Mean	33.6	27.5	26.3	23.5	19.8	18.6	17.6	23.8	2.3	7.35
	M. per ac. % of M.	2688 141	2200 115	2104 110	1880 98	1584 83	1488 78	1408 74	1904 100	184 9.6	588 31

The two areas, Ayer Hitam and Yong Peng, have not been treated statistically as both areas were planted very late and practically obliterated by pests, especially rats and birds.

Pulau Penari Test Plot.

This area is easily accessible by road, is representative of the area in which it is situated, has fertile soil and is sufficiently watered.

With the exception of Nachin 66 all the selected types under trial suffered from lodging at harvest. The results show that all the selected types which were harvested are superior to the local padi Siam control, though none of the selections is superior to the other control type (padi Sultan) which may not have suffered so much from lodging. For next season the local control type of padi Siam, Siam 18 and Nachin 10 might be replaced by the strong strawed types Seraup 48, Radin 2 and Nachin 27 and care taken to plant them all so that they will mature approximately at the same time.

Tangkak Test Plot.

This Test Plot is situated near the town, is readily accessible and well watered. The growth of all strains was robust but all suffered severely from lodging before harvest, rendering that operation difficult and resulting in much loss of grain.

The results show that Siam 29 gave the best yield but was not definitely superior to the local padi Sultan. The poor yields from Nachin 10 and Nachin 11 indicate that they suffered excessively from lodging which may have vitiated the entire test in the season under review. The Siam Kampong, Siam 18 and Nachin 10 might be replaced in next year's trials by Nachin 27, Radin 2 and Seraup 48 as it is evident that some stronger strawed types are needed in this area, while, if space permits, Mayang ebos 201 and Radin 4 might also be added.

Sungei Balang Test Plot.

This area suffered from rats and deep water, (which hampered tillering) and from lodging at harvest, consequently much loss of grain was experienced; moreover, the standard deviation indicates that adverse factors wrought unequal damage with plots. The results show that Siam 29 and Nachin 10 gave significantly better crops than either of the local control types, while Nachin 11 and Nachin 66 also gave better crops but not to a significant degree.

This area is coastal and it is customary to transplant the padi twice so that it would be advisable to substitute Seraup 48 and Radin 4 for Siam 18 and the local padi puteh in next year's trials. Radin 2 and Mayang ebos 201 or 203 might also be added, if practicable.

In general, when due consideration is given to all the circumstances, the results of the padi trials in Johore have been satisfactory in indicating suitable types for the various areas; types in 3 areas showed significant superiority over the local popular types against which they were tested, while in the fourth area treated statistically, one selected type out-yielded the local control variety but not to the degree of significance. Padi Siam No. 29 and Nachin No. 11 show most promise but all the types tested suffered so much from lodging

that the inclusion of some stiff strawed strains in further trials would seem advisable and reference has, in this respect, been made to Seraup 48, Radin 2, Radin 4, Nachin 27 and Mayang ebos 203. In future, attention should be directed to the necessity of planting all the types under trial so as to synchronise reaping and thus minimise losses at harvest due to rats and birds. Further, in introducing new types of padi into various areas, it would be as well to get local cultivators' views on the palatability of the different selected strains which may show promise of heavy cropping ability.

General.

Recommendations as to the trials which should be carried out in the present season, were made earlier in the year and based on the results which have been summarised in this article. In accordance with the need for economy and without loss of accuracy this season's trials have been laid down as "Latin" squares with 1/120 acre as the standard size of plot in place of 1/40 acre (109th acre at Titi Serong) as in the past.

The use of some local popular type of padi as a control in trials has been discarded since last season's experience showed that practically all such control types were derived from previous distributions of selected padi. Such control types are now restricted to new areas, where a standard local type is desirable for comparison, or to areas in which selected strains have, so far, failed to give better returns than the local varieties. At the same time every opportunity is being taken for collecting, isolating and testing any really promising new types which may be found in cultivation, particularly amongst those varieties which mature within a period of 6 months. Further experiments have shown that fair crops of padi can be grown on abandoned, slimed, mining land after the incorporation of organic matter derived by growing green manures on the land for some years. Obvious difficulties render the work of following up the results of distributions of selected seed somewhat arduous but efforts in Krian district in the past season led to the conclusion that considerably more than half of the northern area was planted with selected seed. Similar results were previously obtained in Raub district and a material amount of seed distribution has taken place in many other rice growing centres also. The more popular selections in cultivation are, for soft heavy soils, Radin 2, Radin 4, Seraup 15, Seraup 36 and Seraup 48 while, for other types of soil, Siam 29, Nachin 10, Radin 2, Serendah 824 and Nachin 27 have been planted on considerable areas with, generally, satisfactory results. Ocular demonstrations of the productive value of selected padi strains, such as are now afforded at the numerous Padi Test Plots, will undoubtedly lead to an increasing and cumulative utilisation of seed.

Hybridisation.

Observations on the flowering characters of the more important padi types and a few crosses between them, were made in 1919 with a view to hybridisation

work. Pure line selection was, however, so promising at the time and so many lines were still under trial that further cross-breeding investigations were postponed until the large number of tested selections could be materially reduced in order that cross-breeding work should be confined solely to the most desirable selections. In 1928-29, when an officer became available for work, these investigations were continued and a fairly satisfactory technique was gradually established. The local breeding problem is the synthesis of a genotype combining heavy yield of grain with strength of straw and early maturity, since several otherwise desirable selections lack strength of straw, which is exhibited by other selections of varying maturation periods, and suited to varying environmental conditions.

In the past season, F. 3 seed of 20 hybrid types was sown and from the crops 6 promising selections were made after harvest for sowing as ear-to-row lines in next season for further study. The most promising of these F. 3 hybrids is a combination of the high yielding but late maturing Seraup 36 with the early maturing Radin 2. Other promising crosses of this generation include that between Radin 2 and the still earlier ripening Nachin 27. In addition, F. 1 seed resulting from crosses of Siam 29 with Serendah 875, (17 plants) and with Radin 2 (16 plants) was harvested for sowing in ear-to-row lines next season. These two crosses were made with a view to producing an improved type combining the yield qualities of Siam 29 with the stronger straw of Radin 2 and Serendah 875 and may prove very useful. In planting out these hybrids, the importance of planting single seedlings per hill is stressed as otherwise deductions derived from individual plant examinations become unreliable and of uncertain value. Future breeding work will be limited to crosses of special practical value such as combinations of Nachin 10 and Siam 29 with stiff strawed types.

Summary.

1. Selected strains of padi have been found suitable for most soil conditions in Malaya.
2. In many areas, selected strains have been shown to be productive of better crops than local unselected seed.
3. The increased number of Test Plots has brought padi investigations into closer touch with the cultivators and thus considerably widened the scope for seed distribution.
4. The search for still better strains is being maintained and efforts are in progress to improve existing selections by hybridisation methods.

The following Tables give the figures obtained from mechanical and chemical analyses of the soil from the different Stations.

Soil Analyses.

(a) Mechanical.

Stations		PERCENTAGES					
		Clay	Silt	Fine Sand	Coarse Sand	Gravel	Loss on Ignition
Kendong	T	32	9	43	10	5	7
	S	36	9	36	10	8	8
K. Kurau	T	73	8	7	—	—	14
	S	—	—	—	—	—	59
Selinsing	T	71	13	7	—	—	10
	S	68	7	6	—	—	5
Briah	T	59	20	17	—	—	13
	S	65	16	13	—	—	5
Bruas		57	8	19	9	5	12
B. Gantang	T	53	12	29	7	—	12
	S	41	8	28	12	12	7
Kajang	T	71	7	17	—	—	12
	S	73	7	15	—	—	12
Kuang	T	32	5	41	18	4	6
	S	30	4	43	18	6	5

T = Top-soil.

S = Sub-soil.

(b) Chemical.

Stations		PERCENTAGES						
		C	N	CaO	Sesquioxides	K ₂ O	P ₂ O ₅	MgO
Kendong	T	1.95	.169	.035	10.64	.211	.0210	.0027
	S	1.32	.107	.027	14.67	.215	.0168	.0014
K. Kurau	T	1.96	.172	.133	20.33	.855	.0344	.1988
	S	1.59	.133	.118	15.87	.757	.0455	.0617
Selinsing	T	3.78	.273	.069	21.05	.739	.0342	.0799
	S	2.37	.140	.043	14.11	.699	.0385	.0487
Briah	T	2.83	.231	.045	17.41	.650	.0609	.1197
	S	1.89	.122	.053	23.38	.812	.0319	.0409
Bruas	T	1.90	.151	.040	23.00	.438	.0707	.0395
B. Gantang	T	2.58	.224	.034	22.56	.508	.0620	.0104
Kajang	T	1.79	.161	.039	26.00	.518	.0651	.0031
	S	1.83	.172	.038	26.70	.634	.0518	.0043
Kuang	T	1.50	.096	.038	13.50	.297	.0693	.0036
	S	1.31	.089	.041	17.80	.378	.0630	.0081

T = Top-soil.

S = Sub-soil.

PADI MANURING EXPERIMENTS 1932-33.

BY

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As stated on page 638 of this Journal for December, 1932, the main padi manurial experiment of the Season 1932—1933 was designed to test the possibility of obtaining large increases of yield by combining manuring with close planting. There were also small subsidiary experiments to test the effect of cattle manure, of heavy dressings of nitrogen and of "chelupping" i.e. the dipping of the seedling plants before transplanting in a paste of phosphatic manure.

In Kelantan for the first time an experiment was laid down to test response to manure of various kinds.

Planting Distance, Preparation and Manuring.

Experiments were carried out at the Stations at Telok Chengai, Titi Serong, Talang, Bukit Merah and Pulau Gadong. Unfortunately entirely reliable results were obtained only from the first two Stations; there was severe insect attack in early stages at Bukit Merah, the experiment was entirely spoiled by rats at Pulau Gadong and at Talang recently levelled land was used with resultant uneven growth.

Soil preparation was as follows :—

Telok Chengai :	Ploughed, raked and rolled.
Titi Serong :	Tajaked twice (the second clearing being necessary on account of lack of water and consequent delay).
Talang :	Changkollod twice.
Bukit Merah :	Ploughed (three times) and raked.
Pulau Gadong :	Ploughed, harrowed, ploughed, harrowed (three times).

Chelupping.

The Malay practice of "chelup" consists of dipping the roots and lower parts of the seedlings immediately after their removal from the nursery into a soft paste of manure and water to which earth is sometimes added. The seedlings are then stacked in a shady place for one or three days during which time numerous adventitious roots, copiously covered with root hairs, push through the thin coating of paste adhering to the plants. The practice is followed in parts of Kedah, Province Wellesley and Malacca.

During the course of the season it was ascertained that the method used for "chelup" in connection with the manurial experiments had varied in different places and in Perak, for instance, where the custom of "chelup" does not obtain, seedlings were simply dipped before planting and the stacking part of the process was omitted. Consequently most of the paste was probably shaken or washed off the seedlings during the operation of planting.

The practice actually adopted at the different Stations is tabulated below :—

Telok Chengai :	Dipped in paste of local bat guano and water and stacked for two nights.
Titi Serong :	Dipped in paste of Perlis phosphate and water : no stacking done.
Talang :	Dipped in paste of bone meal and water and stacked for one night.
Bukit Merah :	Dipped in paste of bone meal and water and stacked for two nights.
Pulau Gadong :	Dipped in paste of Perlis guano, clay and water (one part of Perlis guano to two of clay) and stacked for one night.

Manurial treatments were —

- A. Chelupping with bone meal or local bat guano.
- B. Superphosphate supplying 60 lbs. Phosphoric Acid per acre.
- C. Ammonium sulphate supplying 20 lbs. Nitrogen per acre + superphosphate as in B.
- D. Control.

Four replications of each treatment on plots of such a size that 1/40 acre could be measured, leaving sufficient guard rows to exclude bund effect, were employed. These were arranged in a Latin Square, or, where considerations of space prevailed, in a double row on the Latin Square principle. Each plot was provided with bunds, except in Krian.

Each plot was further subdivided into three sub-plots of 1/120 acre each, without bunds, in which planting distances were respectively, that normal to the district, three inches closer each way and six inches closer. Sub-plots were randomised.

It should thus be possible to test the effect of manures, of planting distance and of the interaction of the two.

For the sake of clarity results have been given in Tables A and B in round numbers, weighings were actually made to quarter pounds and for statistical analysis these more accurate figures were employed. Application of the "z" test showed that the differences between manurial and planting distance responses and the reaction between planting distances and manures were all significant, while the "p" values gave the minimal significant differences shown in Table C.

Telok Chengai, Kedah. Padi used—Selected strain Radin 2.

TABLE A.
Telok Chengai.

Planting Distance.	Yield in lbs. per 1/120 ac. sub-plot.	Calculated yield in gantangs* per acre.	Percentage of control† = 100.	Average tillers per plant‡.
15" x 15"	20	A. Chelupped 418	100	15.3
12" x 12"	23	480	115	11.7
9" x 9"	24	500	120	7.8
15" x 15"	26	B. P. Manure 543	130	15.9
12" x 12"	27	564	135	13.4
9" x 9"	27	564	135	9.5
15" x 15"	26	C. NP Manure 543	130	18.6
12" x 12"	28	584	140	14.4
9" x 9"	24‡	500	120	9.0
15" x 15"	20	D. Control 416	100	15.4
12" x 12"	23	478	115	11.8
9" x 9"	22	460	110	7.4

* 1 gantang = 1 Imperial gallon. Weight of 1 gantang of padi from this field = 5.75 lbs.

† Control is taken as unmanured planted 15 x 15 ins.

‡ 20 plants counted.

‡ Damaged by rats.

TABLE B.
Telok Chengai-Summarised.

Manures	Gantangs per acre.	Percentage of Control* = 100.
Chelupped	466	103
P Manure	557	123
NP Manure	542	120
Control	452	100
Distance planted		
15" x 15"	480	100
12" x 12"	527	110
9" x 9"	506	105

* Control is taken as unmanured for manures and 15 ins. x 15 ins. for distance.

TABLE C.

	Between any pairs (pounds).	Percentage increase over control.
Manurial treatment (1/40 ac.) ...	1.6	2.6
Distances (1/120 ac.) ...	2.5	10.60
Combination of manure and distance (1/120 ac.) ...	3.3	12.8

The standard deviation of a single 1/120 acre sub-plot was 8.65 per cent. of the mean, a satisfactory result which proved the contention of p. 639 of this Journal for December 1932 that such plots would suffice for the accuracy required.

Adopting these standards of accuracy we see that all manurial treatments have given significant increases and that planting 12 ins. x 12 ins. is definitely superior to 15 ins. x 15 ins.

From the economic point of view however the experiment has failed and the 'bar' alluded to in previous reports has not been surmounted. At the present low price of padi the response obtained would cover the cost of only the cheap local manure.

Titi Serong, Krian, Perak. Padi used—Pedigree strain N. 27.

TABLE D.
Showing Mean Yields in Pounds per 1/120 acre.

Distance	A. Chelupping	B.P Manure	C. NP Manure	D. Control.
14" x 14"	17	18	17	16
11" x 11"	14	17	15	17
8" x 8"	17	17	16	15

Cursory inspection of these figures suffices to show that no economic results have been obtained and further that, here, closer planting has been without result. Owing to the presence of a few scattered very low-yielding plots the experimental error was high, standard deviation for one 1/20 acre sub-plot being 13 per cent.

Talang and Bukit Merah. As stated above results from these two Stations cannot be regarded as reliable; for what they are worth, neither significant nor economic increases have been obtained as a result of manuring or closer planting.

Manuring Experiment in Kelantan.

Pasir Puteh. Manurial experiments were carried out for the first time on this Station. The layout was in six randomised blocks of plots of 1/40 acre reaped, without bunds.

Treatments and mean yields were :—

Treatments.	Pounds per 1/40 acre.	Gantangs per* acre.
1. Basic slag 2 cwts. Cyanamide $1\frac{1}{2}$ cwts. Sulphate of Potash 1 cwt. per acre	64.3	460
2. Superphosphate (16 per cent.) 2 cwts.	55.2	402
3. Superphosphate + Sulphate of Ammonia $1\frac{1}{2}$ cwts	58.5	417
4. Basic slag 2 cwts. + Cyanamide $1\frac{1}{2}$ cwts.	57.8	413
5. Green manure 1 ton	44.7	320
6. Local manure†	41.0	293
7. Local bat guano (P_2O_5 16 per cent. N 1.8 per cent.) 4 cwts.	56.3	403
8. Control	33.8	242

* Calculated from weight at the rate of 1 gantang = 5.5 lbs.

† A mixture of burnt soil, burnt cow dung and ashes of coconuts and arca leaves in general use in Kelantan under the name "Baja Bakar".

Statistical analysis shows that the standard deviation of a single plot is 6.8 lbs. or 11.2 per cent. of the mean and minimum increase over control for significance of $P = .05$ to be 7.1 lbs.; minimum difference between any two treatments for the same significance is 8.8 lbs. From these figures it follows that the increases due to green and local manure are just significant, while those from all other treatments are highly significant. Differences between treatments 2, 3, 4 and 7 are within the limits of experimental error and are probably due to chance, while the increase due to the addition of nitrogen and potash in treatment 1 over treatment 7 is probably real although the probability of chance occurrence is .07 instead of .05.

The nitrogen content of the bat guano employed is so small that it may safely be regarded as a phosphate manure only and as usual nitrogen is found to be unnecessary. Unfortunately there was no phosphate potash treatment without nitrogen so that it is impossible to say whether potash would have given additional response in the absence of nitrogen. The fact that response was forthcoming is however interesting, since, elsewhere in Malaya and in other tropical countries, potash has been found either to be useless or to have a depressing effect on yield.

The fact that there was no difference between the acid and basic mixtures 3 and 4 confirms results previously obtained elsewhere in Malaya and may owe its explanation to the change in the direction of neutrality found to occur on inundation of many local soils.*

It is interesting to note that the absence of bunds did not prevent attainment of sufficient accuracy.

From the economic standpoint, taking 1 gantang of padi as worth 5 cents (\$1.00 = 2s. 4d.) the increase due to treatments 2-4 and 7 of approximately 167 gantangs per acre would be worth \$8.35. This would be barely remunerative, if 2 cwts. of basic slag or superphosphate costing—say—\$6.50 in Kelantan were used, but should be economic if bat guano can be obtained in quantity at cheap rates, more especially if, as is probable, there is residual effect. It may well be found by further work that smaller applications give the same result. The extra increase of 53 gantangs due to potash would be worth only \$2.65 and would not be remunerative, even if potash without nitrogen produces the increase.

It must be remembered however that, in light soils, continued heavy cropping as a result of phosphate manuring may result in depletion of nitrogen or potash necessitating subsequent additions of one or both of these constituents if cropping is to be maintained.

The large increase obtained on this Station is interesting and recalls the similar increase obtained at Talang in 1930-32, when the plots were sited on an area giving control yields of only 247 gantangs per acre.

In neither case however was the general limit found in Malaya exceeded.

Subsidiary Experiment.

An experiment carried out at Pulau Gadong, Bukit Merah and Talang consisted of four treatments—

- A. Cattle manure applied at the rate of 20 tons per acre.
- B. Cattle manure at $2\frac{1}{2}$ tons per acre + "ammonium phosphate"† (20 : 20) at 100 lbs. per acre.
- C. Ammonium phosphate* (20/20) at 300 lbs. per acre preceded by an application of 200 lbs. of lime one month earlier.
- D. Control.

Plots were of a size sufficient to give a measured area of $1/120$ acre and there were four replications of each treatment arranged in a Latin Square or double banked modification thereof. Each plot was bunded as it was thought that there might be considerable diffusion of nitrogen from cattle manure.

The object of the small dressing of cattle manure in B was to provide possibly lacking bacteria and of the lime in C to neutralise possible development of acidity due to the heavy dressing employed.

* Dennett, J. H. This Journal, p. 518, Vol. XX, 1932.

† "Ammonium phosphate" is used as a generic term for Niciphos, Leunaphos, Ammophos and similar synthetic manures.

Pulau Gadong. Padi employed was Radin Siak, and results are shown in Table E.

TABLE E.

	Mean Yield.			
	lbs. per 1/120 ac.	lbs. per acre.	Gantangs per acre.	Percentage of Control = 100
A. Cattle	24	2880	510	140
B. Cattle + NP	22	2620	475	129
C. NP + Lime	20	2420	435	119
D. Control	17	2040	368	100

1 gantang has been taken = 5.5 lbs.

Statistical analysis gives standard deviation = 9.1 per cent. of mean and smallest difference between any pair for significance = 3.1 lbs. hence all treatments were significant; cattle manure was definitely better than ammonium phosphate and lime but no treatment was economic. There was severe lodging of padi on the manured plots.

Bukit Merah. Padi employed was Radin 4. Results are shown in Table F.

TABLE F.

	Mean Yields.	
	lbs. per 1/120 acre	Percentage of Control = 100
A. Cattle	18	120
B. Cattle + NP	17	114
C. NP + Lime	16	107
D. Control	15	100

Talang. Padi employed was Radin 2. Results are shown in Table G.

TABLE G.

	Mean Yields.	
	lbs. per 1/120 acre.	Percentage of Control = 100
A. Cattle	32	118
B. Cattle + NP	29	107
C. NP + Lime	31	115
D. Control	27	100

Since none of the responses at these two Stations are economical, statistical analysis has not been performed. It is noteworthy that the relatively high response from cattle manure obtained at Pulau Gadong has not been obtained here.

Other Manurial Experiments.

Simple strip experiments to test the efficacy of chelupping were carried out at Biah, Selinsing and Kuala Kurau in Perak; results were—Biah 11 per cent., Selinsing 18 per cent. and Kuala Kurau 1 per cent. increase over control. No result is significant. At Bukit Merah a simple experiment using well rotted buffalo dung was carried out and an increase of 5 per cent. over the control was obtained. This is well within the limits of experimental error.

Combined Cultivation and Manuring.

An experiment designed to test tajaking (scything of weed growth) as against changkolling (hoeing) combined with manuring was carried out at Selinsing, Perak.

Each treatment plot (*i.e.* changkol orajak) was 3/80 acre in extent and was sub-divided into three sub-plots of 1/80 acre, each without intervening bunds, to which were applied phosphatic manure (P) at the rate of 200 lbs. of superphosphate per acre, nitrogenous and phosphatic manure (NP) at 100 lbs. of sulphate of ammonia + 200 lbs. superphosphate per acre and (C) Control. There were four replications of each treatment and therefore twelve of each manure.

Mean results expressed in terms of 1/80 acre plots were —

	Control.	P.	N.P.	Mean.
Changkoll	21.00	24.00	27.25	24.08
Tajak	24.00	25.25	27.75	25.72
Mean	22.50	24.63	27.50	

Statistical analysis showed that the P was significantly better than Control and NP than P (the standard deviation was 2.3 lbs.).

Owing to administrative difficulties, application of manures could not be carried out until after flooding; in spite of this there is no evidence of diffusion. The difference between changkolling and tajaking is small. Had it been possible to carry out these operations earlier, greater differences might have resulted.

An experiment in which ploughing, changkolling and tajaking without manuring were compared at Bukit Merah gave, for the second year in succession, results of no economic significance; figures expressed as percentages are —

	Ploughing.	Changkolling.	Tajaking.
1931 — 1932	108	102	100
1932 — 1933	123	113	100

The only significant difference is that between ploughing and tajaking in 1932 - 33. At Talang a similar experiment showed no significant difference.

Summary.

1. The results of experiments in closer planting combined with manuring are examined and found to give results falling short of economic utility except on light soil in Kelantan, where there appears every chance of raising initially low yields to the level of those on heavy soils on the west coast of the Peninsula.

2. Manuring with cattle manure gave relatively a large increase on one Station out of three.

3. The "bar" of unknown origin discussed in previous reports, beyond which yields in Malaya cannot be raised by manuring, has not been surmounted.

Work in the Season 1933-1934.

In the summary of work 1931 - 32 (this Journal page 642 of 1932) it was shown that the turning in of green matter combined with manuring had produced large effects in experimental padi tanks at the Government Experimental Plantation, Serdang. During the past season tests were made of the effect of

turning green matter into the tanks, six weeks and one week before planting, and of leaving it on the surface. The experiments were largely spoiled by leaks in a large number of tanks, but it was clear that far better growth resulted from leaving the green matter on the surface than from turning it in. This, in a measure, is the practice in Krian and certain other areas in the country where weed growth is cut with a special implement just below the soil surface after flooding and is either left there to rot or, when present in large quantity, partially to rot, the residue being piled on the bunds.

A new series of experiments has been devised for testing in the field a combination of deep cultivation before and after fallow, tajaking, turning in and laying on the surface of green matter and manuring.

In Kelantan it is proposed to test smaller dressings of local phosphate and residual effect of the manures applied last season.

POT EXPERIMENTS WITH PADI.

BY

J. H. DENNETT,

Acting Plant Physiologist.

The experimental work to be described below was set up as the result of a number of field investigations on padi soils.

Great difficulty arises as soon as any attempt is made to compare the appearance, rate of growth and yields of padi grown in different parts of the country. However carefully it is guarded, certain factors affecting results will apply to one area and not to another. There may be shortage of rain in one area, superabundance in another, a third area is, perhaps, badly attacked by pests while on a fourth results may be vitiated by the raids of rats and birds.

It therefore seemed a reasonable plan to collect soils from various parts of the country, as far as possible representative of well known areas, and to attempt to grow the same padi on all of them under exactly comparable conditions. Even if the conditions were not as good as in the field they would be exactly comparable with each other, but they should, if possible, be on the general lines of field trials.

Ordinary dry-padi trials in pots did not seem a very helpful line of approach. Previous experience frequently showed that growth was largely vegetative and formation of grain could not be depended on.

The scheme evolved therefore was to grow padi in pots, which should be sufficiently large to give the plants a reasonable area from which to draw their nutrition, and further that these pots should be irrigated.

The containers were made of unglazed earthenware with two holes in the side, one at the top and one at the bottom. The bottom was closed with a cork which could be removed to run off any seepage water if necessary. The upper hole was fitted with a cork through which a quarter-inch galvanised iron "bend" passed. The pots were placed on long series of stepped terraces with fifteen steps in all. Continually flowing water was supplied from taps to all the pots on the top terrace. The pots were filled with soil to within two inches of the upper hole. When water in the top row reached this hole it flowed through the "bends" into the pots on the step below and so on right down through the whole series of pots, the water from the bottom pots flowing off down the drain. Water was kept flowing sufficiently fast to prevent any possibility of mosquitos breeding. All the pots were enclosed in wire cages to keep out birds.

Each pot contained about 70 kilos (150 lbs.) of soil. Soils in the first case were obtained from :—

- (1) Titi Serong (Perak).
 - (2) Selinsing (Perak).
 - (3) Pulau Gadong (Malacca).
 - (4) Kamunting (Perak), (reslimed mining land).
 - (5) Kuala Lumpur (ordinary type quartzite soil).
- About two months later two additional soils were added —
- (6) Lenggong (Perak) (high yielding area).
 - (7) Kuala Pilah (typical granite padi land).

Each lot of soil arrived in some twenty four sacks. The contents of each sack was carefully mixed and then mixed with the contents of the other sacks. The actual procedure was to take a portion from the sack equal to $1/30$ of the total weight of the contents and mix it thoroughly with a similar portion from each of the other sacks. This finally mixed portion was roughly weighed into pots, there being thirty pots to each soil type.

These thirty pots were arranged in two lines down the fifteen steps of the terrace, but the two lines of the same soil were not contiguous, lines from the other four types coming between them.

There were then in the first place ten lines of pots arranged in fifteen rows one above the other. When the Lenggong and Kuala Pilah soils were added there were then fourteen lines in fifteen rows. The general lay-out will be readily realised from the photograph on Plate I.

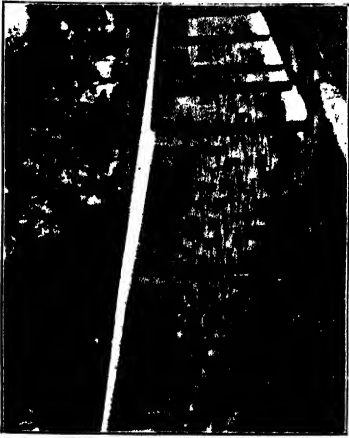
The Objects of the Investigation.

What exactly were the questions which it was desired to answer? In the first season these were somewhat confined and were as follows:—

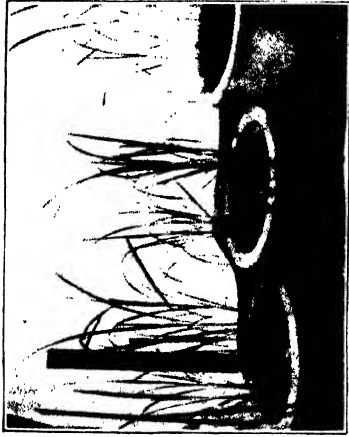
- (i) would such a design of lay-out give a sufficiently even growth with each soil type to make any comparison of types possible?
- (ii) if the answer to the first should be in the affirmative would the yields obtained be comparable with those obtained in the field?
- (iii) would there be significant differences in the yields obtainable from the different soils under examination?
- (iv) what differences are there in the soil to account for these differences in yield and would such observed differences (in soil) shew any relation to differences in yield?
- (v) would the first year's results indicate the probable utility of the method for general manurial experimentation?

The answer to the above has been very satisfactory as a whole and has in some respects exceeded the writer's expectations. They are discussed in detail below.

One of the outstanding results has been the very even growth within each line. It was thought possible that there might be definite differences in the appearance of upper and lower pots. So even has the growth within lines shewed itself that it does not appear necessary to have the whole of one line



GENERAL VIEW 2 MONTHS.



KUMUNTING 2 MONTHS.



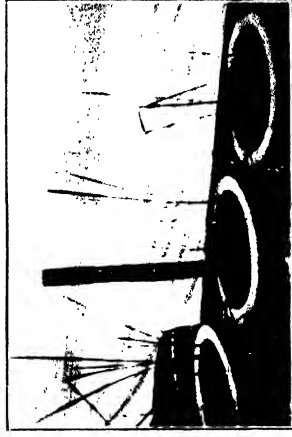
KUALA LUMPUR.



Lenggong 2 months.



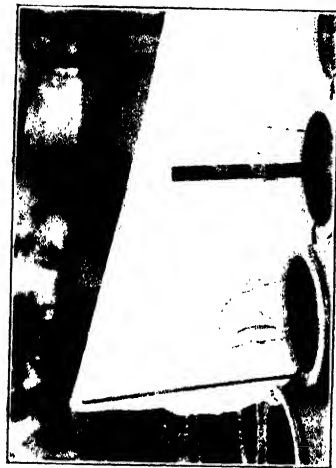
Selanging 2 months.



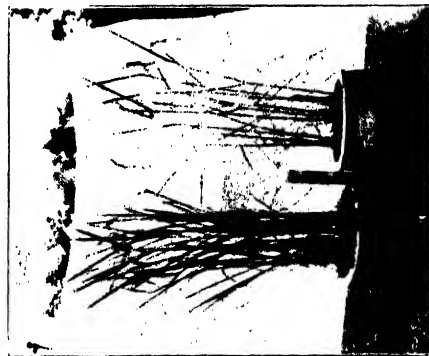
KUALA PILAH.



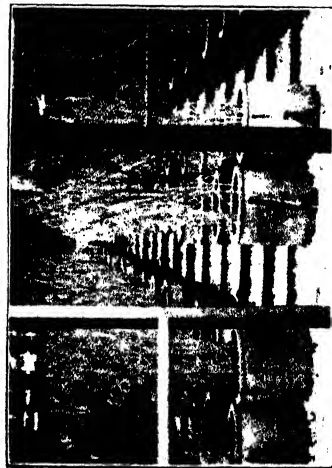
TITI SERONG 2 MONTHS.



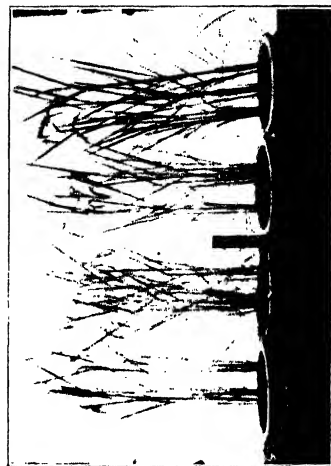
MALACCA 2 MONTHS.



LENGGONG AND TITI SERONG.
AT HARVEST.



GENERAL VIEW AT HARVEST.



AT HARVEST.

concerned with one treatment only in any future manurial work. This evenness is most likely due to very careful mixing of the soil before potting.

Experimental.

The answer to the other four questions will be obtained by a discussion of the work carried out, the observations made and the crop yielded.

The nursery was planted in an extra pot of Malacca soil, the seed used being a Nachin F.S.27. Growth was even and rapid and the seedlings were planted out 21—23 days after the date of sowing *i.e.* 19.4.33. Water had been flowing over the planting out pots for 14 days previously. Growth did not appear to suffer any check after transplanting and the evenness soon became apparent; out of 450 plants only one required supplying. At an early stage it was realised that a fairly normal growth could be expected.

Some two months after planting it was decided to add soil from Kuala Pilah, as representing large areas of alluvial growth padi soils and, on the suggestion of the Director of Agriculture, soil from a known high yielding area (1,000 gantangs per annum) at Lenggong (Perak).

Observations.

Differences in vegetative growth soon became apparent. "Kamunting" forged rapidly ahead of the others, shewing very rapid tillering and from its general appearance, gave promise of good yields. Next came "Titi Serong" in which tillering and growth was less rapid but the plants appeared to be stronger with rather bigger leaves of a darker colour. Next in order came "Selinsing" which gave few tillers but all were sturdy. Fourth came "Malacca", general growth of which appeared rather poor at this stage. Last came the Kuala Lumpur quartzite. Four months after planting, although still green, the latter showed practically no growth from the nursery stage.

The two later soils, "Lenggong" and "Kuala Pilah", shewed remarkable differences. The former shewed much more rapid growth even than "Kamunting" and, in actual appearance, rapidly surpassed all the others which had been growing for two months longer. It did not tiller to quite the same extent as "Kamunting" but shewed a much stronger growth with less tendency for early tillers to die back, more coming to maturity. "Kuala Pilah" on the other hand shewed even a slower growth than "Malacca", with little tillering but with an intense dark green colour.

Flowering was first observed in the "Kamunting" pots on 27.8.33, four and a quarter months from planting out or five months from seed. At this stage the comparative positions had changed. Much of the energy of the "Kamunting" padi had been expended in purely vegetative growth and, although the number of flowering tillers was 3.7 per plant, the straw was thin and poor and the ears not very heavy. "Malacca" on the other hand had greatly improved in growth by the flowering stage, giving 2.5 tillers per plant with a good straw. The

strongest straw and finest ears from the first planting were obtained from "Selinsing". The excellent early growth of "Lenggong" was maintained and, although planted two months after the others, it was only three weeks behind in flowering. It gave a remarkably long and strong straw with big, well developed ears.

The actual yields obtained are given in Table I, together with the mean weight of plants two months out of the nursery. Such standard error as occurs between pots is largely due to the fact that plants were removed from a pot to obtain this mean weight and then immediately replanted and, although these plants nearly all reached maturity, their yield was below the mean.

Many of the figures given in Table I may appear of superficial interest but one of the points under investigation is the relation if any of yield to vegetative growth. Taking the figures for weight of plant at two months it will be seen that "Kamunting" was five times as heavy as "Malacca" and four times as heavy as "Selinsing", yet the yield of grain from "Malacca" is slightly higher and from "Selinsing" considerably higher.

On the other hand in the case of "Lenggong" excellent vegetative growth has been maintained up to harvest so that the conclusion is that such early growth may or may not be a criterion of grain formation and it would appear that such growth in some cases partially exhausts the plant.

The comparative growth at two months is shewn in the Plates.

This is well in keeping with observations made in the field where, frequently, early vegetative growth is greatly enhanced by manuring without any corresponding increase in grain.

The mean yield per acre is calculated from the mean superficial growing space of each plant. The area so available was 59 square inches against the standard planting of 144 square inches. This suggests overcrowding. Results however, in another paper in this issue indicate that very little difference occurs between 9 and 12 inch planting, *i.e.* between 144 and 81 square inches so that it might be expected that there is a balance between individual yields and planting distances; the number of tillers per unit area is probably the same.

In any case the fact remains that yields were obtained, at the rate indicated in the Table, for what is not generally regarded as optimum conditions.

On the other hand although soil conditions are not equal to the field it must be borne in mind that the soils had the equivalent of good ploughing when mixed and the actual irrigation conditions were rather better than the field, it being possible to regulate the water at will in a few seconds.

In this connection it should be noted that in no case was the water more than $1\frac{1}{2}$ inches in depth.

Plants were slightly attacked by stem-borers but at so late a stage as to do but little harm,

TABLE I.

Summary of Growth and Yields.

Factor.	No. of row.	Titi Serong Soil.	Selin-sing Soil.	Malacca Soil.	Kamunting Soil.	Kuala Lumpur Soil.	Lenggong Soil.	Kuala Pilah Soil.
Mean No. of tillers at 2 months	1st row 2nd "	2.82 2.93	1.22 1.33	2.46 1.50	6.0 5.55	Nil "	6.35 4.80	1.25 1.0
Mean fertile tillers at harvest	1st row 2nd "	2.91 2.56	2.73 2.78	2.77 2.22	3.85 3.55	died at 3 months without growth	4.84	
Mean height 2 months	1st row 2nd "	3' 0" 2' 6"	1' 6" 1' 2"	2' 6" 2' 6"	3' 0" 2' 6"	0' 5" 0' 5"	3' 3" 3' 0"	3' 3" 3' 0"
Mean height at harvest	1st row 2nd "	3' 6" 3' 5"	3' 11" 3' 6"	3' 2" 3' 5"	3' 4" 3' 1"	— —	4' 4"	
Mean weight in grammes of plant at 2 months	1st row 2nd "	22.4 20.5	10.3 11.5	11.6 6.5	50.8 40.4	1.26 1.0	171.0 168.0 approx.	9.0 10.0 approx.
Mean weight in grammes of grain per tiller	1st row 2nd "	3.87 3.29	4.27 4.42	3.98 3.70	2.56 2.82	— —	5.09 4.70	5.23
Mean weight in grammes per pot		28.98	38.05	27.19	26.28	—	69.23	
Mean yield in gantang per acre dried padi		403	527	377	365	—	960	
Mean weight of dried straw	1st row 2nd "	576 621	640 759	540 470	604 573	— —	1352	
Mean weight of dry stalk	1st row 2nd "	224 256	273 260	184 186	233 258	— —	500	
Ratio mean grain/straw		0.72	0.815	0.805	0.672	—	0.768	
Ratio mean grain/stalk		1.81	2.14	2.20	1.62	—	2.07	

Differences.

It will be remarked that there is a difference between the yields of the two rows of the same soil in each case. The only difference in treatment was that the first row of each soil was kept free from weeds and algae while the second row was untouched.

While observations were made on growth, examination was made of the soil. In order to arrive at a reliable estimate of differences the examination was made in quintuplicate, the results being submitted to statistical analysis in much the same way as the actual crop yields. Further in order to attempt to arrive at some estimate of soil activity, observations were made on the decomposition of green matter with all these soils under anaerobic conditions. Water was kept flowing over the soil. The gas given off was collected and analysed while measurements were further made of the nutrients removed by this run off water, but results are not yet available.

The figures obtained for the soil are given in Table II. The figures shewn at the head of each column represent the significant difference for that particular nutrient. This only refers to the soil and not to padi yields.

Measurements of change of conductivity of the soil, taken straight from the pots, and after seven days drying out are also given. These measurements are frequently used as an index of fertility.

TABLE II.

Soil	Absolute change of conductivity. $\times 10^{-4}$	CaO 0.042	K ₂ O 0.127	MgO 0.021	C 0.40	N 0.03	C/N 4.5	P ₂ O ₅ 0.028	Mean yield per acre in gantangs
Titi Serong	2.62	0.018	0.696	0.215	2.32	0.220	10.8	0.055	403
Lenggong	0.84	0.116	0.528	0.132	2.23	0.200	11.1	0.108	960
Kamunting	1.56	0.050	0.258	0.031	1.59	0.137	11.7	0.104	363
Kuala Pilah	0.49	0.050	0.484	0.022	2.47	0.175	14.1	0.019	
Selinsing	0.39	0.047	0.680	0.113	3.49	0.313	11.0	0.092	527
Malacca	0.18	0.046	0.690	0.033	1.87	0.102	18.5	0.028	377
Kuala Lumpur	0.28	0.021	0.065	0.025	1.13	0.060	18.5	0.015	

Results of statistical analysis shewed that the effect of removing algae, weeds, etc. was only slight, the block variance being 37 while the random variance was 131.

For the usual standard of $p = .05$, difference in yield between any two soil types for significance is 4.75 grms. per pot or 66 gantangs per acre.

It will be observed that "Lenggong" was significantly better than the rest. "Selinsing" was significant over the other three while "Titi Serong" just about reaches significance over "Kamunting" but not over "Malacca".

Any attempt at relating yield with soil analysis is difficult but there seems to be a curious relation between calcium and magnesium content and yield as far as the figures obtained are concerned; this is probably entirely a matter of coincidence.

Examination of the ash content and composition is still in progress and at the moment only the results of analyses of stalk and leaf are available, those of grain and roots will not be finished for some eight weeks more.

For this purpose the stalk, leaves and roots from every three pots were collected separately, dried and "ashed" at a very low temperature. This gave ten separate ashes for each part of the plant for each type of soil. In the case of the grain it was not found practicable to keep separate every three pots and so the whole was bulked and then divided into ten portions for ashing.

The mean analyses for stalk and leaf are given in Tables III and IV together with the significant differences for $P = .05$.* The mean ash analyses are given in percentages of ash and the Nitrogen and ash percentages are given on dry material.

TABLE III.

Stalks.

Growing on soil from	Ash	Silica SiO_2	Phosphate P_2O_5	Calcium CaO	Magnesium MgO	Manganese MnO	Potash K_2O	Nitrogen N	Yield
Malacca	12.72	51.09	1.394	1.357	0.583	0.234	32.88	0.311	377
Kamunting	9.56	50.21	1.601	1.205	0.607	0.610	33.11	0.260	363
Titi Serong	10.81	58.56	1.707	0.862	1.199	0.466	29.61	0.217	403
Selinsing	12.62	60.63	0.456	1.181	0.689	0.176	27.23	0.370	527
Lenggong	12.74	61.63	2.376	0.965	0.888	0.652	27.41	0.370	960
Significant difference	1.87	3.05	0.365	0.131	0.147	0.043	2.30	0.033	66

It will be seen from these figures that there are very definite differences between the ashes and their constituents for the same padi grown on different soils as far as the stalk and leaf is concerned. No particular constituent, however, is directly proportional to the yield.

* $P = .05$ means that the likelihood of such results being chance ones is only five per cent.

TABLE IV.
Leaf.

Growing on soil from	Ash	Silica SiO ₂	Phosphate P ₂ O ₅	Calcium CaO	Magnesium MgO	Manganese MnO	Potash K ₂ O	Nitrogen N	Yield
Malacca	9.22	77.74	0.670	4.132	0.605	0.202	7.725	0.417	377
Kamunting	10.52	77.81	1.215	3.222	0.535	0.568	5.596	0.371	363
Titi Serong	12.25	81.21	0.847	2.579	1.188	0.735	3.146	0.355	403
Selinsing	14.93	84.27	0.232	2.831	0.422	0.124	4.520	0.355	527
Lenggong	14.14	83.35	0.808	2.489	0.749	0.680	4.104	0.389	960
Significant difference	1.08	2.94	0.120	0.374	0.161	0.096	1.01	0.059	66

The percentage of silica appears to increase with increasing yield while the percentage of potash decreases. The phosphate content of the stalk (the direct feeder of the grain) stands out very decidedly in the case of "Lenggong". On the other hand the consistently low phosphate content in the case of "Selinsing", the next highest yielder, is just as remarkable. There seems to be but little proportion between yield and manganese. Calcium and magnesium shew no relation with yield but shew some tendency for their sum to be constant in the case of stalks.

It remains, however, that differences in the soil do cause differences in the ash constituents even for the same variety of padi though nothing definite can be said until the results for the whole plant are available. There is cause for enquiring whether the percentage obtained for any one constituent can express adequately the part played by that constituent. For the purpose of obtaining a better expression of results the relationship of total constituents to yield, and the relationship of each constituent by itself, is being explored.

Summary.

1. It is believed that the method described of growing padi in irrigated pots for general experimental purposes is a satisfactory one.
2. Yields approximating to those of the field are obtainable while the ravages of birds and pests can be largely prevented.
3. The chemical analyses of the soils indicate that the better yielding soils are definitely richer in plant nutrients.
4. It is shewn that there are significant differences in the ash analysis of both leaves and stalks from the same variety of padi grown on different soils.
5. It is believed that the method will prove to be a very economical one for the purpose of trying out manurial combinations.

IRRIGATION AND DRAINAGE OF PADI AREAS.

Compiled by

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Introduction.

In the Report of the Rice Cultivation Committee which was presented to Government early in 1931 the following remarks appear:—

“It is clear that the most important question involved in stabilising and increasing the cultivation of padi in Malaya is the provision of better control in relation to water supplies. It should be emphasised that means for getting water off the land are quite as, if not more, important than means for getting it on and that a late season is always a bad season, which is an additional argument for special attention to major drainage without which control of rice planting is impossible. We have examined the various aspects of the case very carefully and have come to the conclusion that the only satisfactory solution lies in the establishment of an independent Drainage and Irrigation Department which will be executive in the Federated Malay States and the Straits Settlements and advisory in the Unfederated Malay States.

We consider that the nucleus of this will probably be found in the existing Hydraulic Branch of the Public Works Department of the Federated Malay States and we recommend that this should be developed on the lines of a joint Straits Settlements and Federated Malay States Department with advisory function in the Unfederated Malay States.”

Following on this recommendation the Drainage and Irrigation Department was organised on the lines above indicated at the commencement of 1932, and the present writer was appointed Director of Drainage and Irrigation, Straits Settlements and Adviser of Irrigation and Drainage to the Malay States. At the outset a programme was laid down by the Department and work on certain items of the programme was commenced in the early part of the same year. Developments have to a certain extent been handicapped owing to the necessity for the most rigid economy consequent on the financial position of the various Governments concerned. Nevertheless during the intervening period considerable progress has been made and, as the information concerning these works is largely confined to official reports and is not always fully available to the general public, the following account of the principal schemes in progress, together with a statement of the present position, has been compiled for publication in this rice number of the *Malayan Agricultural Journal*. The operations undertaken by the Department up to the present are concerned mainly with the work in the

Federated Malay States and in the Straits Settlements and, in the following pages, the operations in progress and contemplated are described under these two heads.

SCHEMES IN PROGRESS—FEDERATED MALAY STATES.

Perak.

The Sungei Manik Irrigation Scheme :—A large area of potential padi land exists in Lower Perak, near Teluk Anson, on the north side of the railway line, the estimated cost of developing which will amount to probably \$350,000. It has been decided to develop this area in stages, and a completed scheme of drainage and irrigation has been carried out for the first stage which is expected to bring into cultivation an area of roughly 5,000 acres. Briefly, the scheme consists of two main irrigation channels one on the northern and one on the southern side of the existing Sungei Manik drain, and entails the clearing of about 400 acres of jungle and of about 200,000 cubic yards of earthwork for the excavation of main canals and distributaries.

Felling and clearing operations were started in April last year, but, owing to the necessity for economy, unfavourable weather conditions and floods, the work was interrupted on several occasions and in consequence is only now approaching completion. It has been executed at exceptionally low cost.

Pumping Scheme to Irrigate Riverine Areas, Perak River :—A scheme to irrigate padi lands in the mukims of Bota and Lambor Kanan, below Parit, has been approved by Government and an order has been placed for suitable plant to pump water from the Perak River into a canal, 12 miles long, for the irrigation of 12 areas of padi land totalling 2,400 acres on the left bank of the river. The cost of the plant and 16 miles of canal is estimated at \$30,000 and it is thought that the water rate from 2,300 acres will be sufficient to pay the cost of maintenance and interest at 4 per cent. on the capital cost as well as depreciation of machinery at $7\frac{1}{2}$ per cent. on the estimated first cost of \$8,000.

This scheme is of an experimental nature and on its success depends the progressive expansion of the rice area, which should be possible by establishing additional pumping plant and pumping stations along the river bank. There is a large area of potential padi land in the Perak River valley amounting to about 130,000 acres on the right bank and about 30,000 acres on the left bank of the Perak River.

Selangor.

The Sabak Bernam Peninsula Drainage Scheme :—A scheme for the drainage and bunding of the Sabak Bernam Peninsula has been planned, costing about \$180,000. This Peninsula consists of an area of about 28,000 acres, bounded on the north by the Bernam River, on the west and southwest by the Straits of Malacca, while the eastern limits run up in part to the boundaries of European estates and in part to the Bernam River. The whole area



1. CONSTRUCTION OF AN IRRIGATION CANAL
AT SUNGAI MASTIK.



2. CUTTING AND REGRADING FOR DRAINAGE,
PROVINCE WELLESLEY.



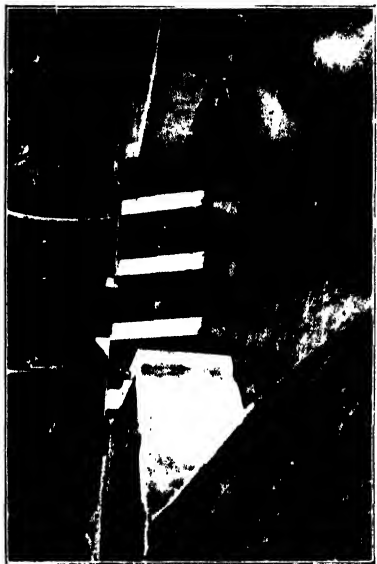
3. AFTER REGRADING, PROVINCE WELLESLEY.



4. IRRIGATED SAWAIL, NEGRIS SEMBILAN.



SENCEI BULOIL IRRIGATION CANAL HEAD SLUICE.



CHOPONG DAM AND GATES.



THE INTAKE AT SENCEI BULOIL.



THE INTAKE AT SENCEI MANIK.

is very flat, considerably below high water level of spring tides, and would flood twice daily but for the natural protection afforded by nipah and bakau forest along the sea coast. Such protection cannot be relied upon when the development of interior lands becomes extensive, and the scheme now proposed provides for a continuous bund to keep out the sea water, provision being made for the necessary tide gates and also for a system of internal drainage which, with the existing drains, should be sufficient.

Small sums were spent last year in maintaining parts of existing work and on the preparation of an experimental bund. A sum of \$50,000 has been provided in the current Estimates, but approval to commence work was only given at the end of August and up to the present about \$2,000 have been spent on preliminaries. While this scheme is not exclusively for padi growing it will have a considerable bearing on the adjoining potential padi areas of Panchang Bedina and Sungei Tinggi.

Panchang Bedina Padi Arca:—A controlled drainage scheme for an area of approximately 15,000 acres at Panchang Bedina, near Sabak Bernam, on the Selangor Coast has been undertaken by the Department. The scheme includes the construction of 4 main gates and 20 subsidiary gates and involves the felling and clearing of about 566 acres of jungle and about 750,000 cubic yards of earthwork. The area to be dealt with is divided into 17 units and internal gates are provided for the efficient and independent control of the water table in each unit, each gate controlling about 700 acres.

Eleven gates were completed last year and about 200 acres of jungle were felled. The jungle, which is largely nibong, is water-logged and felling operations proved a difficult proposition. Working conditions were very bad during the wet season and difficulty was experienced last year in obtaining labour at the low rates ruling. The contractors are required to employ all Malays who apply for work at rates similar to those paid to other nationalities. Fresh contracts have been let out this year for jungle clearing, earthwork and other items at considerably higher rates and good progress has been made on the construction of the control gates; more than 75 per cent. of the jungle clearing has been completed.

The scheme is estimated to cost \$250,000 which will bring the cost per acre to the low figure of \$17. The soil has been analysed by the Agricultural Department and has been pronounced to be eminently suitable for the growing of padi.

The Sungei Buloh Padi Scheme:—The scheme provides for the irrigation of a minimum of 700 acres situated adjacent to Mile 15—Mile 18 on the Sungei Buloh road. Water will be led from the Sungei Buloh, which has been raised by a weir at a point on the existing access road to the Sungei Buloh Forest Reserve, by irrigation channels contoured along the sides of the valley. Two gates are fitted to the inlets for these channels one on either side of the valley, and two crossings of tributaries—the Sungei Plong on the right bank and the Sungei Subang on the left bank—are provided for by reinforced concrete flumes.

Sanction was given to commence work in April this year and progress has been satisfactory; the headworks have been almost completed but the construction of irrigation channels has been delayed by land resumption.

Pahang.

Sungei Blat Irrigation Scheme:—A scheme was prepared in 1932 for the drainage and irrigation of about 3,500 acres in the district of Kuantan. The scheme is estimated to cost \$25,000 and consists, primarily, of the careful control of the natural drainage of the area by bunds and water gates and, subsequently, the construction of irrigation canals leading from the Sungei Pandan. The proposal entails the construction of about 700 chains of bund and the erection of 15 control gates.

Work was started after the monsoon period this year and is now more than 75 per cent completed; about 400 acres of jungle were given out on temporary occupation licence for felling and clearing for padi.

The soil survey conducted by the Agricultural Department shewed that most of the irrigable area has good rice-growing soil: the area is within 4 miles of the largest town and port of Pahang and there are good prospects for successful padi cultivation.

Kubang Karah Irrigation Scheme:—This is a small scheme also in the Kuantan district, originally projected in 1928, and on which some work was done by the Public Works Department. The essence of the scheme is the damming of a clear water stream—the Sungei Nyor—by a low earthen embankment to provide a reservoir about 60 acres in area, for supplying water to about 80 acres of existing and 200 acres of potential padi land.

Surveys and investigations were made by the Drainage and Irrigation Department in 1932 and a revised scheme prepared which involves the construction of spill weirs and repairs to the dam constructed by the Public Works Department.

Progress on the work has, unfortunately, been interfered with by delay in land resumption.

Minor Padi Areas (Temerloh District):—Several minor padi areas have been opened up in scattered portions of the Temerloh district from a block vote provided for the purpose, and control gates have been built this year for such areas at Sungei Nyak Besar, Mukim Kertau; Paya Didalu, Mukim Sangang; Paya Tuallang, Mukim Perak.

Drainage and Irrigation of Small Padi Areas:—A block vote of \$4,000 has been provided for the "Drainage and Irrigation of Small Padi Areas" and is allotted to the various District Officers who collaborate with the Drainage and Irrigation Engineer as to the best manner in which the money should be spent. A sum of \$350 is all allocated for a small area at Pulau Jawa (Pekan) to be spent from Headquarters.

Irrigation and Drainage Works for Padi Cultivation :—A sum of \$9,000 was spent last year in improvements to existing padi areas throughout Pahang where there are over 30,000 acres of padi land, and such work resulted in the extension of these areas by about 1,500 acres; this work is being continued this year. In the Temerloh and Bentong districts, the schemes are prepared and executed by the Drainage and Irrigation Engineer, while in the other districts, the work is in the hands of the District Officer concerned who acts in consultation with the Drainage and Irrigation Engineer.

Negri Sembilan.

Erection of Dams :—During the current year, dams were built at the under-mentioned places, in some cases to replace temporary structures and in others to bring a larger area of sawah under irrigation :—Kampong Solok, Rantau; Kampong Sungai Machang Ilir; Ampang Jeram; Kampong Inas.

A tide gate was also constructed at Sungai Chuah.

STRAITS SETTLEMENTS.

Malacca.

Irrigation Scheme at Chohong :—This scheme provides for the irrigation of approximately 672 acres at Chohong adjoining the Malacca/Johore boundary. The original scheme designed by the Public Works Department in 1926 comprised the construction of dams, watercourses and the bunding of the river banks, but the scheme was modified by the Drainage and Irrigation Department at the beginning of last year and bunding was dispensed with, as it was considered that this would be unnecessary since the primary cause of the floods would be removed when the clearing and drainage of the lower reaches of the Kesang River was carried out.

The Chohong and Kesang Rivers form the boundary between Malacca and Johore territory and the approval of the Johore Government was obtained for the construction of the headworks. A gate has been provided at the inlet of the irrigation canal so that the draw off can be controlled and, at all times, half the available water can be used by the Johore Government. The scheme was completed in July this year and is functioning satisfactorily.

The Bachang—Tanjong Minyak Scheme :—The original proposals for the development of the Bachang Swamp and Tanjong Minyak areas were mooted about half a century ago, but it was not until 1931 that a definite scheme was prepared by the Public Works Department. The work was taken over by the Drainage and Irrigation Department early in 1932 when a modification of the scheme was effected; a considerable reduction was made in the estimate while the area to be brought under cultivation was increased from 2,600 to about 3,000 acres.

For the Bachang area, the scheme prepared is one of controlled drainage; this area suffers from severe flooding by the Malacca River and a bund has

been built about 245 chains long running parallel to the Malacca River to prevent such flooding. The Tanjong Minyak area consists mostly of swamp land and is also liable to flooding and the scheme, now in hand, provides for the drainage and irrigation of the area.

These areas are entirely separate from each other, but a combined scheme has been formulated to include both areas, thus reducing the unit cost per acre.

Owing to the financial position it was only possible to make a start on the scheme at the end of 1932, but it is anticipated that construction will be completed by the end of the current year (1933) while there is every prospect that all the land rendered available by the scheme will be shortly taken up and cultivated. The area in question is situated two miles from Malacca town and is readily accessible by road.

Minor Schemes in Malacca:—Minor irrigation schemes have been carried out and paid for from a block vote of \$6,000 provided for this purpose at the following places—Chabau, Pulau Sebang, Sempang, Gadek, Alei, Rim.

Province Wellesley.

Revoked Forest Reserve—S. Acheh Coast Region:—Two tide gates are being constructed on two small rivers in the S. Acheh Coast region with the object of reclaiming some 430 acres of land, formerly a forest reserve. This is part of an extensive scheme to bring into cultivation about 4,550 acres of land in Province Wellesley by water led from the Krian Irrigation Reservoir. (Reference to this is made later in this article).

The work also entails the construction of a bund to keep out sea water, but this is being done by the Malay cultivators themselves and, on completion, each worker will be awarded 3 acres on Statutory Grant, no rent being payable for 10 years.

Alma Canal—Outfall Drain to S. Junjong Mati:—Good progress has been made with the construction of a drainage canal to connect with the Alma Drain and Sungei Junjong Mati in P. W. Central. This is expected to bring into cultivation an abandoned padi area of 100 acres. The line of the canal crosses the Bukit Tambun Company's land, but the Company has surrendered the necessary strip of land free of cost.

Clearing Drainage Channels:—During the present year, nearly 62,000 cubic yards of silt were removed from the drainage channels in Province Wellesley and about 1,900 chains (about 24 miles) were cleared at the same time. The sums provided for this purpose are, however, small (\$8,300), and larger amounts could with advantage be expended on these operations, which are of prime importance if the conditions of padi cultivation in Province Wellesley are to be improved.

(In Malacca, a vote for a similar purpose amounting to \$16,000 is under the administration of the Rural Board).

Dindings.

Padi Area at Sungei Tuntong:—This is the largest padi area in the Dindings at present and a portion of it is liable to flooding each year by sea water. It is proposed to bund an area of about 400 acres, half of which is cultivated, the remainder lying under coarse grass, reeds and shrubs. The cost including three water gates, is estimated at \$9,500. A supplementary vote of \$1,000 was approved in 1933 to be spent on repairs to the existing bund and gate which are essential for the protection of the area at present under cultivation, and it is hoped that the completion of the scheme will be provided for in the 1935 Estimates.

PROJECTED SCHEMES.

In addition to the works now in hand, designs have been prepared for several schemes, the execution of which, it is hoped, will be carried out in 1934 or later. The schemes of major importance coming under this category are given below —

Perak.

Extension of the Krian Irrigation Works and Additional Supply to the Reservoir:—A scheme has been prepared for enlarging the supply to the Krian Irrigation Reservoir by a diversion canal from the Sungei Ijok via the Sungei Merah. The increased supply of water is required for the needs of the Krian irrigation areas and it will also be possible, by raising the main canal banks, to irrigate the large areas of padi land in the trans-Krian area in Province Wellesley as well as the old forest reserve in the mukim of Kuala Kurau. In all, about 10,475 acres will be brought under irrigation as a result of this project, 4,550 in Province Wellesley and 5,925 in Perak (of the latter some 2,000 acres are already under cultivation) the estimated cost of the proposal is \$375,000 which will be shared between the Perak and Colonial Governments. Both Governments have approved the principle of the scheme and a token vote appears in 1933 Colonial Estimates from which certain works mentioned above are being carried out in the S. Acheh Coast region.

Negri Sembilan and Pahang.

Triang Ilir Scheme:—Extensive surveys and investigations were carried out last year on a proposed padi area in the valley of the Triang River on the borders of Negri Sembilan and Pahang and a tentative scheme for the irrigation of an area of 4,500 acres (1,570 in Negri Sembilan and 2,930 in Pahang) was formulated, costing approximately \$250,000.

Owing to financial stringency, Government has decided not to embark on this scheme up to the present time.

Malacca.

The Duyong Scheme :—This scheme has been designed to institute controlled drainage over an area of 4,400 acres and is capable of extension ultimately to 5,400 acres. The area to be dealt with lies in the valleys of the Sungei Parit China and the Sungei Duyong including the tributaries of the latter, the Sungei Ayer Molek, the Sungei Ayer Panas and the Sungei Gapam. About 1,740 acres are at present under padi. In order to obtain efficient control over the whole area, all rivers in the area are to be bunded and internal drainage is to be effected through 23 outlets into these rivers. The proximity of the area to Malacca town will facilitate supervision and maintenance of bunds. The scheme is estimated to cost \$90,000 or \$16.66 per acre (for 4,400 acres, it will cost \$20.50 per acre). The soil has been reported upon by the Agricultural Department and has been pronounced to be suitable for padi cultivation. This scheme will be put in hand in 1934.

The Sungei Putat Scheme :—The Sungei Putat valley which is adjacent to the town of Malacca and lies in the water-shed of the old Malacca impounding reservoir, contains 972 acres of which 400 acres are already under cultivation; the upper end of the valley is in blukar and the lower end is subject to periodic flooding from the Malacca River.

The scheme, which will be carried out next year (1934) is intended to supplement ordinary rainfall and to utilise the water from the reservoir if possible; at its lower end, it is proposed to protect the area from flooding by a bund and, generally, the drainage of the whole area is to be improved.

Judging by rainfall returns, it is expected that the impounded water will only be required for two months in the year, *viz*, August and September. A small additional reservoir for storage will be created at the off-take from the main stream. This area is about 46 acres in extent and averages 3 feet deep.

The scheme is estimated to cost \$36,000, including land acquisition, and the cost per acre will be approximately \$37.

Kesang—Sebatu Scheme :—A tentative scheme has been prepared for the development of the Kesang—Sebatu area and the Merlimau forest reserve, which may be expected to bring about 4,500 acres into cultivation. The scheme depends on the improvement of the Kesang River which will cost about \$175,000; this work will benefit about 20,000 acres on the Johore side.

Penang.

Bund etc. at Sungei Rusa :—A bund and water gates are required for the protection of some 1,108 acres of agricultural land at Balik Pulau (about 560 acres of which are under padi) and which are rapidly going out of cultivation owing to damage by sea water. The area is stated to contain some of the best padi land in the whole of Malaya.

The work will be undertaken in 1934; the scheme comprises the construction of a sea bund and two tide gates to deal with drainage, one at S. Rusa and

the other at S. Ayer Hitam. While providing the required protection for the existing padi fields, the scheme prepared by the Drainage and Irrigation Department is expected to bring into cultivation an additional area of about 140 acres.

The preceding account gives a brief summary of the many operations undertaken by the Irrigation and Drainage Department for the improvement and extension of rice cultivation. Insufficient time has yet elapsed for their influence on the output of rice in the Malay Peninsula to become apparent, but there is every reason to believe that, in due course, the effect will be seen in material additions to the production of rice in the Peninsula.

It should be added that in addition to the above projects, the advice of the staff of the Department has been freely given in connection with irrigation and drainage problems arising among cultivators themselves, both direct and also through the agency of District Officers, Land Officers, Penghulus and Agricultural Department Officers. Irrigation Boards and Committees have also been set up in a number of States and Settlements in accordance with the recommendations of the Rice Committee, while the Advisory Committee for Krian Irrigation Scheme, the existence of which is provided for in the Krian Irrigation Enactment but which has never previously functioned, was inaugurated and has proved itself to be a valuable body. On all these Boards and Committees the Irrigation, Agricultural and Lands Departments are represented, while there are also one or more unofficial members.

It may be added that in certain of the Unfederated Malay States, particularly Kedah and Kelantan, appreciable advances have also been made in the introduction of improvements in Irrigation and Drainage in rice areas, and Irrigation Officers are stationed in both these States. The work is, however, at present uncorrelated to that of the Federated Malay States and it has not in consequence been found possible to include an account thereof in this paper.

IRRIGATION DAMS FOR SMALL RIVERS.

BY

B. O. BUSH,

Senior Drainage and Irrigation Engineer.

These notes are written as the result of frequent reference to the Drainage and Irrigation Department from District Officers, Agricultural Officers and others for advice and assistance on the subject of damming rivers for irrigation at a minimum of cost or for repairing old temporary dams which have become dilapidated.

The subject is rather more complicated than is generally realised and it is thought that these notes will be of greater service if (even at the risk of repeating the obvious) they deal in detail with the facts underlying the cause of the many failures of damming small rivers by the present accepted methods.

One of the most perplexing problems which confronts the Irrigation Engineer in this country is that of providing a permanent dam, in comparatively small rivers, at reasonable cost.

The demand for such a dam is constantly encountered and the problem is a particularly vexing one because almost everyone (engineers and laymen alike) feels that there ought to be a simple solution.

In almost every case the following factors occur:—

- (a) The area to be served is small, from 200 to 400 acres.
- (b) The river to be dammed runs through the alluvial material which is almost the same in all inland valley floors.
- (c) The catchment area is small and the head waters, where the river runs as a torrent through a sandy bed interspersed by rock shoulders and boulders, are not far distant.

Facts Relating to Catchments.

Taking the catchment area first the chief difficulty is that the smaller the catchment the greater is the run off rate per square mile. In a catchment area of about 100 square miles a run off at the rate of more than 60 cubic feet per second per square mile will occur so seldom that it may almost be ignored. On a small catchment of 3 to 7 square miles, however, a run off at the rate of 300 to 400 c.f.s. per mile is by no means an uncommon occurrence. Thus the range of flow for which a dam must be designed on a small stream is out of all proportion to the range required for a fair sized river.

A small catchment may have a maximum run off of 2,000 c.f.s. and yet the total yield may fall in dry weather to as low as 5 or 6 cubic feet per second.

It is an extraordinary fact that, while in this country we may safely consider that the maximum yield of a 100 square mile catchment will not exceed about 6,000 c.f.s., the rate of flow in perhaps a dozen of the small catchments, which form part of the main catchment and which contribute to a flood, may all exceed one third of the maximum rate for the whole catchment of 100 square miles. The explanation of this of course lies in the time lag for the maximum run off to arrive at any point after rain has commenced to fall. The time lag becomes greater all the way down the river. This interval of time is called the time for concentration.

It will be obvious that the provision of a permanent dam in the Kinta River at Ipoh would be a work of great magnitude, but considerable astonishment is expressed by those who have not examined the problem when informed that a lasting dam for a small stream cannot be installed by depositing a few hundred dollars worth of concrete, though it seems to be a mere trickle compared with the river at Ipoh.

Difficulties of Foundations.

The next difficulty in order of importance is the type of land in which one is usually required to build "small dams" of the type under review. A better way of expressing this would be to say dams for small rivers for, as shown above, a dam for what is normally a small river must be designed to accommodate a run off equal to as much as one third of the maximum known flood of the Kinta River in Ipoh which in the past has caused such extensive inundation in that town.

Valley floors are almost always composed of light clay to a depth of 5 to 10 feet under which is found running sand and coarse material to a great depth. The material under the clay is usually clean and seldom cemented together by fine soil. In most cases water will readily percolate through the lower layer. In many valleys the depth of clay is as little as three feet and special and expensive precaution must be taken to prevent the escape of water under the foundation of the dam.

Damage Caused by Dams.

The natural section of streams of this kind is, almost without exception, never large enough to take the flood discharge of its catchment and, in times of flood, the stream overflows its banks and inundates large areas of surrounding country. This innundation subsides naturally and will return to an unobstructed river channel without much damage, but, since the purpose of a dam is to raise the water level on to its upstream side, it follows that an unnatural and destructive water-fall effect is caused by all water returning to the water course on the down-stream side of a dam. In a permanent dam wing walls and aprons have to be exceedingly large and strong to keep such damage within safe limits.

The destructive water-fall action which occurs just below a dam may to some extent be overcome by providing sluice gates which when open are suffi-

ciently large to ensure that the presence of the dam causes little or no obstruction, but such gates add to the cost and are of course useless if not opened at the proper time. The proper time to open sluice gates is almost always at night, soon after or during an evening's heavy rain; this is because in small catchments the time for concentration is small and the maximum flood arrives at the dam soon after the rain has fallen. The work of gate opening is unpleasant, frequently laborious and in consequence often neglected. As far as the writer knows, the perfect inexpensive automatic gate, capable of performing its function under all conditions, has yet to be invented though many experiments to that end have been tried.

These are the major difficulties of making permanent dams on small streams at economic cost. The area to be served is invariably small because, as has been shown, rivers of this kind will dry up to a flow of five to ten cubic feet per second which of course is only sufficient to irrigate an area of 200 to 400 acres, or even less, if waste of water is permitted.

Seasonal Dams

The temporary dam, therefore, is, in the majority of cases, the only alternative. In India, dams, of what the Malay type should be, are referred to as "seasonal dams" and, for the reasons given later, it would undoubtedly be an excellent thing if such a name could be adopted in this country, because it implies a structure which is put up for a limited period only.

The chief mistake made in temporary dams is the tendency to make them too substantial. The question constantly arises as to how a certain dam may be strengthened by using the inexpensive and limited materials available. The answer almost without exception is that the dam in question is already too strong and has reached its present precarious condition solely because, in the past, efforts have been made to over-strengthen it.

To understand this it is necessary to examine certain properties of the streams of this country. The beds of such waterways are never stable. They are composed mostly of running sand which is continually rolling down from the upper reaches. It is only those who have studied rivers who realise how great this movement of sand and other material really is. When artificial causes of wash such as opening up, jungle clearing etc., do not exist in the region of the source, nature itself continually provides new supplies of sand and gravel by extensive land slips. The scars of these land slips are a familiar sight on almost all the hill sides of Malaya.

Properties of River Beds and Causes of Failures.

Because small rivers are never far distant from the steep uplands of the head waters, their beds are charged with an unusually high percentage of moving material. The bed of a stream resembles a long inclined table down which a layer of sand is rolling continuously. If an obstruction such as a wooden plank

is suddenly put across the table, the sand below the plank continues to roll down, leaving the bare table exposed, and the sand above the plank tends to mount up against the obstruction. Supposing the sand running down the table were one foot deep and a plank say two feet wide were suddenly forced edge wise through the sand down to the table surface, for a few moments we have an exposed width of plank of one foot high above the sand. In a very short time the sand below the plank will roll on and disappear while the sand above will accumulate in depth until it reaches the top edge of the two foot plank.

Supposing the plank were a dam in a river bed, its immediate effect would be to raise the water level by about one foot and it is assisted in keeping upright by support of the sand through which it has been forced. In a very short time however, due to the natural movement of the bed, the plank is no longer holding up one foot of water but two feet of sand and it has nothing on the down stream side to support it.

Now comes the cry that the dam is not strong enough. It never will be. The bed below will always become deeper and the load of sand and water above will always become greater. A step, which is very difficult to support, has in fact been formed in the bed of the river and the height of the step will become greater and greater as time goes on. A large hole in the river bed below the usual Malay dam is a most common sight. The more substantial the dam the greater the hole and the example of the behaviour of water and sand on an inclined plane has been given in detail to explain that the hole is caused not so much by the water-fall over the dam but by the natural movement of the river bed. The only true preventive is to make a small dam over which not only water but sand can easily pass during floods and, when the irrigation season has passed, to pull out the dam and let the river restore itself to normal.

The ideal arrangement of course is to have no dam at all. If the off-take from the river is sited sufficiently far up the valley, water may be intercepted at a level high enough to make a dam wholly unnecessary. It is very difficult indeed to persuade the cultivators to do this.

The writer knows a case where great care was taken in siting an off-take. The river was levelled and the irrigation channel made to enter it at a point where the water level was high enough to fill the channel without obstructing the stream. The work was entirely successful but, in spite of everything, the local cultivators actually put a jungle roller fence across the river below the off-take presumably because they were quite unable to believe that it would continue to function without a dam!

Sometimes of course it is not possible to get far enough up the valley to dispense with the dam entirely but, as a principle, if any temporary dam has to raise the water level by more than 12 to 18 inches, in order to perform its function, the site should be abandoned and another found further up the river.

Against this principle comes the opposition to a channel passing through lands not benefited by the water but this difficulty should not be insurperable.

Suggested Design for a Seasonal Dam.

An excellent seasonal dam may be formed in the following manner, usually at less expense and labour than is often expended annually on attempts to bolster up an old dam where the river has been badly damaged by past mistakes.

A moderately straight length is chosen at a point where the widest section of the river exists. Width is very important because it reduces the depth of surcharge of water over the dam when the stream is in flood. No attempt should be made to follow the favourite method of fixing a solid fence of stout jungle poles across the stream. A row of light, jungle sticks should be driven into the river bed in a line across the river. These sticks should be $1\frac{1}{2}$ to 2 inches in diameter, and at least one foot apart, and should be driven into the river bed until the tops are a few inches below the dry weather water level. At intervals of two or three feet, similar rows of sticks should be fixed. Each row should be quite two feet up-stream of its neighbour and the height of each successive row should be an inch or two only greater than the next row below it. This process is continued until about one chain of river has been treated—say thirty rows. Care must be taken to see that the upstream rows are not too tall. They should not exceed the height of the shortest row of sticks at the extreme down stream end by more than 18 to 24 inches depending on the amount of damming effect required. The next step is to fill the spaces between the sticks with brush wood, wattle, leaves etc. This mat of twigs may be lightly pegged down, if it shows too great a tendency to float away. The mat should be thicker and more dense at the sides to prevent damage to the banks. By depositing the brush wood evenly and closely the water level up-stream may safely be raised by 12 to 18 inches.

The great advantage of working on these lines is that the dam has a large foundation area. Movement of the sand in the river bed will take the form of producing a flat slope rather than an actual step. Anything which can be done to increase the area of the foundation of the dam is all to the good. Any fence-like structure composed of a continuous row of poles is doomed from the start, no matter how large the poles are or how firmly they are driven.

It is not claimed that the dam described above is the only suitable type of seasonal dam but it may be stated with confidence that it covers the general principles necessary for success. If the requirements of a wide crest, a large area of foundation, lightness, cheapness, ease of removal, bank protection etc. are provided for in any other design there is no reason to expect failure.

Reasons for Removing Dams each Season.

At the end of the season every particle of the dam must be removed and this is easily done if the whole structure is properly made of the lightest materials. If a few heavy floods occur while the dam is in action they will probably wash out some of the brush-wood. It is all to the good if this should

happen because the river channel will suffer correspondingly less and the wattle and twigs are easily replaced. It must be remembered that the movement of a river bed is at its greatest during a flood.

Something unpleasant will inevitably happen during large floods if a temporary dam is too substantial, for rivers like steam boilers must have safety valves. The irrigation channel will become hopelessly overloaded and large quantities of sand will be carried into it if the dam remains intact. Sometimes the sand travels far enough to ruin the upper reaches of the planted lands or, at the best, the laborious task of lifting the sand out of the irrigation channel must be met when the flood subsides. If the sand nuisance is not present to choke the waterways, flood damage will often take the serious form of enlarging the irrigation channels until they become large enough for the stream itself and the river forms a new bed, at the same time destroying much of the original scheme of irrigation.

In the Sri Menanti valley for example three or four old beds of the Sungei Sri Menanti may be seen, all of them probably caused by the river being forced by a strong dam to usurp an old irrigation channel for its new channel. Old river beds of this kind are an endless cause of trouble. Irrigation channels have to be flumed to cross them. If they are not very carefully banked off they act as a drain just when they are not wanted to and vast quantities of water are lost in this manner. It is only when difficulties of this kind are encountered that one begins to realise the wisdom of protecting and respecting existing river channels and keeping them in good order.

The removal of the dam at the end of the season should be an easy task but it is absolutely essential, in order that the river may restore its bed to normal, and it will undoubtedly do so if given the opportunity.

These points are stressed because it is known that many of them are quite contrary to the inclination of the ordinary type of cultivator. He invariably chooses the narrowest possible part of the river. He thinks by doing so he will save labour. He selects the heaviest stakes he can get and drives them as firmly as he can into the river bed. The admirable desire to make a good job of work is, in this case, most unfortunate because he is up against a natural force which is rather beyond his understanding. He does everything he can think of to make a temporary dam a permanent one, all to no purpose, and, at the end of the padi season, the structure is forgotten and what remains is permitted to continue to damage the river channel.

Every kampong Malay will admit that it is easy to dam a river for the first time when the site is undamaged. He knows quite well that, with each successive year, his difficulty will increase. If he can be persuaded to construct a light dam and to remove it thoroughly every year he will always be in the happy state of having an undamaged site to deal with.

DRY PADI IN KELANTAN.

BY

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Statistics of the area of land planted with padi in Kelantan have in the past been given as 147,329 acres but it may not be generally appreciated that of this area 35,073 acres, or roughly 24 per cent., are under dry padi cultivation. The actual figures given are believed to be inaccurate but it is at least probable that the ratio of areas under wet and dry types is correct.

The land planted with dry padi falls into two groups, that habitually under the dry crop and that which may be utilised for either the wet or dry type. The latter forms but a small proportion of the whole and comprises the lower lying dry padi or tugalan lands the choice of wet or dry padi for any particular year depending on the inclination of the cultivator or, in some cases, faith in the Siamese calendar of a 12 year cycle. Generally speaking the fields are flat or slightly sloping and in the latter case wet padi land is found at the bottom of the slope, dry padi land over the main area and the intermediate or alternating type mentioned above in a narrow strip between the two.

Throughout the dry padi areas lots are divided and demarcated by bunds, a fact which is referred to in a subsequent paragraph.

The soil throughout the dry padi lands is markedly homogeneous and, though occasional ridges of slightly sand soil are found, a heavy loam predominates.

In view of the localised nature of the crop it is not surprising to find that there are only some twelve distinct varieties cultivated. The maturation periods of these varieties varies from 173 to 197 days and, though the majority can only be used as dry padis, there are some which can also be successfully planted on wet land. That yields at least approach those of wet padi was shown in a recent trial in which two varieties each gave an average yield for 10 plots of over 350 gantangs (1,925 lbs.) per acre, and the average yield of the entire planted area, including one (wet) variety which gave only 90 gantangs (495 lbs.) per acre, proved to be 220 gantangs (1,210 lbs.) per acre. Such yields are apt to give a false impression and lead to the belief that improvement of dry padi crops will obviate the need for irrigation in many areas. This is not the case, as irrigated padi will give a steady return over a number of years independent of weather conditions, whereas the success or otherwise of the dry padi crop is dependent on a favourable monsoon. Dry padi moreover calls for an amount of labour and care which not all cultivators are prepared to give and which is

greatly in excess of that required to produce a crop of the wet type. The crop however is well worthy of attention and, in order to indicate the difficulties of the cultivator and suggest possible lines of improvement, this article has been written.

In considering the cultivation of dry padi in Kelantan a number of facts must be borne in mind. This State, unlike the western States of the Peninsula, suffers from a marked dry season, which may extend from the middle of February until the end of May, but which varies in duration and severity. This dry season is followed by showery weather in July and August, the showers becoming more frequent until they reach a climax in the monsoon. During the dry season the land bakes so hard that the local plough with a rounded sole and sharp turn on the mould board is barely able to penetrate the soil and the small local cattle, which have to exist on the sparse grazing provided by baked padi fields, are unable to drag the implement effectively.

In preparation for the crop the peasant commences ploughing at the end of June or early July when the land has been softened by rain but has dried out sufficiently to avoid any danger of puddling. The land is turned over to a depth of approximately two inches and in dry weather is subsequently harrowed down. The soil is then allowed to lie for a period of about 10 days when it is said to be "masak." Should rain fall after ploughing the furrows break down and harrowing is unnecessary. These operations are repeated twice more with the appropriate interval between cultivation, the objects being to attain a depth of cultivation of about $3\frac{1}{2}$ inches and to kill weed growth. Finally the land is ploughed and harrowed a fourth time and seed planted in rough lines by dibbling in on same day; subsequent cultivation is confined to weeding which is performed by cutting down the grass with a short knife at varying intervals.

Throughout these operations from the preliminary ploughing to the last weeding the utmost care is taken to avoid puddling the land or packing it unduly.

If the crop is to be a success it is essential that the plants should be well established and some 12—18 inches in height before the land becomes waterlogged. If planting is delayed the plants do not become sufficiently developed before water commences to stand in puddles on the surface, they do not tiller, weeding cannot be efficiently performed, and the crop is poor. On the other hand, once the plants are well established and all weeds removed, the crop is unharmed by an excess of water. Certain varieties, notably the short term and therefore late planted varieties, are less resistant to excessive water than others.

As an important point in the cultivation of this crop is to avoid puddling the soil, it follows that weeding should be completed before showers become a daily occurrence; thus it is advisable that the actual planting be completed early in August. This, however, may be a matter of difficulty. If the dry season has been severe and protracted the peasant with his poor plough and draught

animals is unable to commence work until the land has been thoroughly softened by rain and subsequently, owing to the shallow furrow turned by the plough, he has to plough four times to obtain sufficient depth of cultivation. The four ploughings, together with the periods between ploughings, retard planting, until, by the time the crop is ready for weeding, rain is a daily occurrence and weeding ineffectual, being actually harmful by causing puddling.

The necessity for four ploughings to achieve sufficient depth of cultivation, and also with the object of eradicating weeds is open to doubt, but this has been the custom for a very long time and the cultivators continue to follow the methods practised by their progenitors.

In considering methods of improvement of yield manuring and seed selection present themselves as the first and most important lines to be followed, while the customary cultural processes may also be improved. As regards seed selection it should be confined to the medium and long term varieties since the short period types induce cultivators to plant late, with the result that weeding cannot be effectively executed and the padi is insufficiently mature to withstand water-logging when rains become frequent.

The observations in this article suggest a number of minor activities covering a wide field which will all tend to improve and stabilize the yield of dry padi and these may be summarised as follows:—

- (i) Education of the peasant in animal husbandry, the growing of fodder and grazing grasses to enable his stock to be kept in better condition and to provide food capable of supporting improved stock.
 - (a) Experiments with better implements.
 - (b) Devising of means for the provision of better implements.
 - (ii) The popularisation of imported, light steel ploughs capable of ploughing the land to a sufficient depth in one operation.
 - (iii) The provision of tine harrows which will have a breaking effect on the soil rather than the compressing effect of the local harrow.
 - (iv) The provision of tine cultivators to carry out rapidly those functions at present effected by the last three ploughings.
 - (v) Education of the peasant in mulching and weeding of the crop during dry spells as opposed to the cutting of weeds as commonly practised at present.
 - (vi) Insistence by Government on early planting, followed by cultivation of the crop.
 - (vii) The elimination of bunds which hold up rain water and thus tend to spoil the crop and the substitution of drains to remove the water.
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RICE MILLING IN MALAYA.

Compiled from Records Existing in the Department of Agriculture.

BY

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and

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Economic conditions, combined with the intensive campaign for the extension of rice cultivation which has been in progress during the past three years, are already beginning to create a state of affairs which requires that attention should be paid to the question of finding markets for the disposal of padi, surplus to the personal and domestic requirements of the growers themselves.

The encouragement of production, coupled with the depressed condition of the rubber industry, has already resulted in increased yields in many districts and there have been considerable extensions in area so that in many localities there is now becoming available for the first time in the history of Malaya, a surplus above the immediate consumption needs of the local population which is available for sale to other areas; in consequence, and unless the policy of stimulation of rice production is to fail, it is necessary that steps should be taken to provide a means for the disposal of such surplus crops at fair and reasonable rates. Amongst the chief difficulties in marketing padi are its bulkiness and the necessity of milling it before it can be used for human food. The bulkiness of padi is reduced in volume by approximately 55 per cent. and in weight by 37 per cent. in milling so that it is evident, that where transport to distant markets is necessary, the padi must first be converted into rice.

Accordingly the question of milling padi is rapidly assuming increased importance and, in order to provide a readily available source of information on the subject, the following brief account of the process of milling padi in its various aspects has been compiled.

In the East the term 'padi' is generally applied to unhusked rice grain and before this padi is fit for human consumption the husks or outer coverings of the grain, which are very tough, fibrous and indigestible must be removed and separated from the kernels. This separation is effected by various methods which mainly consist in causing vigorous friction amongst the grains either by direct pounding or by rapid rotation so that the husks are cracked against a hardened surface. Furthermore, in order to improve the appearance of the husked kernels, which are normally pale-brown in colour, they are usually submitted to some form of polishing effected by further friction which strips

off the buff coloured outer layers of the kernels where the proteins and fats of the rice are mainly situated. The extent to which this polishing is effected is indicated by the whiteness of the rice which is, in addition, frequently 'pearled' to give it the glassy appearance demanded for a high quality commercial product. High polishing is associated with a loss of nutrition since it is found that highly polished rice contains less protein and fat than rice which is under-polished such as that eaten by Malays in their kampongs.

The general sequence of operations in a self-contained commercial mill of the medium or larger type, in which the padi is circulated by mechanical conveyors, begins from a hopper situated conveniently for the loading of padi from the padi store. The padi is then conveyed to the cleaning machines where dust, dirt and empty grains are eliminated, the cleaned padi passing on to the sheller where the husks are separated from the kernels.

Thereafter, the milled mixture is sieved to remove any small broken kernels; the husk is fan separated and collected for use as a fuel which provides the power to drive the mill, while the remainder goes on to the separator from which unshelled padi is returned to the sheller. The husked kernels, which are often called 'brown' or 'cargo' rice, are further passed through the polisher, or whitening cone, from which the bran is bagged, the polished rice frequently receiving a second polishing course before being sieved. The rice is then conveyed through the winnower and grader where it is separated into whole rice, large broken and small broken rice which are bagged separately.

Rice Mills in Burma.

In Burma commercial rice milling is performed by very large mills situated at the ports, with capacities varying up to 500 tons of padi daily, and by smaller mills scattered all over the rice producing areas of the Province, while a considerable amount of milling of domestic supplies is done in hand mills. The large milling companies purchase their padi supplies through brokers who may receive advances from the companies or finance their own purchases. These companies produce 'cargo' rice which is exported to Europe and elsewhere for remilling, or 'white' rice which is exported for direct sales. The smaller mills, of which there are over 500, vary in capacity from 25 to 75 tons of padi per day (50 tons = 20,000 gantangs) and are engaged mainly in the production of 'white' rice for local sale or for export, though a fair quantity of parboiled rice is also milled chiefly for export to India and Malaya.

Many of these small mills, for want of sufficient capital to purchase padi or as a result of speculation, have been forced to cease operations during the existing economic depression. The practice of buying in supplies of padi, milling it, sending the rice to Rangoon for sale and depending on the proceeds of the sale to purchase further padi supplies has proved a losing game on the falling markets which have been experienced in the past few years. On the

other hand, the purchase of supplies of padi against definite demands has led to payment for padi on rising markets so that, in times of rapid fluctuation in price, millers have sometimes experienced losses in the year's working.

Many of these mills are hired out by the season to brokers and under existing economic conditions these hired mills have fared best in recent years.

Milling in Siam

Formerly milling in Siam was conducted entirely by very large mills to which padi was transported from all over the country but within the past 10 years, small mills have sprung up 'like mushrooms'. This change has been ascribed to an effort on the part of millers to overcome transportation costs, the rice being sold for local consumption as well as to big millers and dealers in Bangkok. In the early stages, these mills undoubtedly proved profitable but under existing conditions many have experienced losses and closed down.

Exclusive of Bangkok districts, there are over 700 small mills in Siam of capacities varying from 3 piculs of rice per hour up to 28 piculs, the majority being of 6—10 piculs in capacity. Moreover the quality of the product of these mills has been claimed as being equal to that of the large mills in Bangkok.

Native Methods of Milling in Malaya.

The native methods of preparing rice from padi suit the economic conditions in areas where little or no surplus padi is produced, since, at harvest, scarcity of labour which is keenly felt in all large padi growing districts renders it impossible to convert all the harvested padi into rice within a short time. In consequence the padi is stored as such and milled later at leisure according to immediate requirements. This procedure has the double advantage that stored padi retains its flavour better and is less subject to pests than stored rice.

The Malays use two types of mechanical contrivance in milling their padi. In the commoner type the padi is pounded in an enclosed space while in the second type the husks are split by friction between revolving surfaces. The commoner type is known as the "Lesong" of which there are 3 forms designated the "l. tangan", the "l. kaki" and the "l. ayer" according to whether hand or foot or water power is used respectively. These domestic mills are so common that detailed descriptions are superfluous, but it may be stated briefly that, in principal, their action depends on friction between the grain caused by pounding with a hard and heavy implement.

Using the "lesong tangan" or the "lesong kaki" a Malay woman can mill approximately 3 gantangs of padi within an hour, and these types of "lesong" are so simple in design that they can readily be made in the "kampong".

The "lesong" ayer" is identical with the "lesong kaki" except that arrangements for harnessing available water power are installed in addition and frequently this type of "lesong" is worked as a battery of 4 or even 6 machines.

The cost of a "lesong ayer" depends largely on a ready supply of water power, while each unit in a battery is capable of milling 6 to 7 gantangs of padi in an hour.

Usually in all these forms of "lesong" the padi is hulled, winnowed roughly and hulled a second time before the final winnowing, while the percentage of broken rice depends on the age and condition of the padi and on the care exercised by the operator.

The second type of native mill is known as the "Kesaran" in which, of two grinding surfaces similarly constructed of "bakau" chips sunk into puddled and hardened clay, the lower one is fixed while the upper surface is pivoted and can be revolved by hand power with the aid of a simple mechanical device. The "Kesaran" when worked by an energetic Malay can mill 20 gantangs of padi per hour and, if the padi is in good condition, a high grade of rice is produced.

This type of mill costs about \$25 and can mill some 4,000 gantangs of padi before the grinding surfaces need to be renewed.

In addition to the native type of mills already mentioned cattle driven mills are in use in a few places. In principle, these consist of a revolving beam which pounds the padi placed in a circular trough of some 12 bags capacity, but the method is rather slow although a good product is obtained.

In winnowing rice the Malays frequently make use of the breeze to blow away the hulls and bran from the milled mixture as it is poured from a height of about 6 feet. More often, however, this operation is skilfully performed by using the "niru", a wide shallow basket, with a rim about one inch deep, in which the milled mixture is dexterously rotated to work the offal to one side from which it is ejected by a smart jerk of the wrist. In some of the larger padi producing areas the "pengipas", which consists essentially of a box in which a fan is rotated by hand so as to create a stiff breeze, is used. The milled mixture is poured slowly through the artificial breeze which effects a separation of the rice from the chaff very efficiently.

Introduced Methods of Milling—Small Milling Units

When imported rice prices were higher efforts were made amongst estates, situated in areas where surplus padi was normally produced, to induce them to install small milling plants and to purchase padi for milling under estate supervision.

While these efforts had in view the provision of good rice for estate labourers, at cheaper rates than those current for imported or commercial rice, their main objective was the creation of competitive padi buying for the benefit of the cultivators, who up to that time had suffered severely at the hands of middlemen buyers of padi for supply to Chinese owned mills. Resulting from these efforts several estates purchased small power mills while one independent commercial mill was established in Province Wellesley. Some of the estate mills functioned with eminent satisfaction for several years, capital costs

being recovered and handsome sums being saved for the benefit of the coolies concerned, who also benefited by obtaining their rice, in full measure, at materially lower prices than those prevailing in the local shop.

Unfortunately, in the last few years the influx of abundant supplies of very cheap rice from Burma and Siam has nullified the good work done by estate milling units, which have been forced to close down so long as such cheap imported rice tends to make local estate milling unremunerative. The mill which gave most satisfaction was that of the 'Engleburg' type which originated in America but which has since been imitated in England with various added improvements, by several makers, under different names, the 'Planters' Mill', the 'Ajax', the 'British Rice Huller', the 'McKinnon' and others.

This type of mill occupies little space, is easily erected, simple in its adjustments and the size generally used only requires 6—8 h.p. to drive it efficiently, while the rice produced (parboiled) is of excellent quality.

In principle, this type of mill consists of a ribbed metal cylinder which is made to revolve rapidly within an enclosed space into which the padi is fed. The padi is hulled as it circulates with the cylinder by being struck on a fixed 'hulling bar' of hardened metal.

The output of these mills was found to be about 60 gantangs (480 lbs.) of clean rice per hour when, as in most cases, the padi was put through the mill twice, which indicates that the main defect of this type of mill is that it does not separate the milled from the unmilled kernels nor is the bran separated from the husk.

In one case, where white rice was produced, a separating arrangement was added to the mill by which the milled mixture was separated into good and broken rice, chaff, bran and unmilled kernels, the latter being remilled. In this instance broken rice and bran were sold at fair prices, whereas usually no separation of these products was adopted and consequently their value was lost. Milling costs with these types of mill were computed at 1.2 cents per gantang of rice, exclusive of depreciation and supervision on one estate, and at 1.4 cents on another estate, the padi in each case giving 44 per cent. of rice by volume measurement.

Most of the estate mills produce parboiled rice only, since Indian coolies prefer parboiled rice to white as it keeps better and is more easily cooked and, incidentally, is more nutritious than polished rice. The parboiling process involves soaking the raw padi for 24 hours, preferably with at least two changes of water, and then heating to boiling point for 20 minutes after which the padi must be thoroughly dried before milling. The parboiling of the padi tends to make it swell slightly and hardens the kernels so that breakage in milling is reduced.

Local Large Milling Units.

There are no really large mills in Malaya in comparison with the big mills of Burma and Siam, the majority of the local large mills having a maximum capacity of under 250 bags of rice per day. All the commercial mills in this country are situated in or near the large rice producing districts of Kedah, Province Wellesley, Penang and North Perak and, with the exception of two Government mills, they are all owned by Chinese.

In Kedah there are 21 mills, of which only 18 have been worked regularly in recent years, and of these 3 are large mills while 15 are of medium size having capacities of 3—4,500 gantangs of padi per diem. The bulk of the output from the mills in this State is polished white rice, since Malays do not eat the parboiled product.

In Province Wellesley there are 8 mills of which only 6 are operating. One of these is a large mill of 22,000 gantangs daily capacity, 4 are of medium size and one is quite small. In this area 80 per cent. of the output is parboiled rice to be consumed by Indian labourers.

In Penang there are 11 mills, 4 of which do not operate at present, 4 are small mills, one is of medium size and 2 are large mills while 75 per cent. of the production is parboiled rice.

In North Perak there are 3 large mills of which 2 are owned by the Government; the larger of these has not been in operation for some years owing to shortage of padi supplies. Approximately 90 per cent. of the output of these mills is parboiled rice. In addition there are several small power mills on estates in the Krian district, but none of these is operating at present for reasons already mentioned.

All the smaller mills in the country usually obtain their entire padi supplies from local cultivators, but the medium and larger mills purchase not only local padi but supplies shipped from other areas and, in exceptional years, have even imported padi from Burma and Siam.

Additional Observations.

In its present stage the problem of small and medium power milling in Malaya is urgently in need of further investigation and experiment with particular reference to the most economic and efficient type of mill and milling organisation to suit the needs of newly opened padi areas. Wherever a padi mill is designed to afford an outlet for surplus padi production, provision for storing large quantities of padi in connection with its operation must be considered, since cultivators usually require to sell all their surplus padi within two months of harvest in order to raise cash to pay for rent and other necessities.

In existing padi areas domestic storing arrangements are inadequate for retaining surplus padi and this state of affairs would certainly be still more keenly felt in newly opened areas; consequently, unless padi cultivation becomes

a more profitable occupation than it is at present, there is little prospect of any mill being successful unless abundant storage accommodation is made available.

This problem indicates the need for investigation of the possibilities of bulk storage of padi at mills, in contrast to storage in bags as practised at present, and it would seem that, if due precautions are taken in regard to the moisture content of the grain, bulk storage should give satisfactory results. In point of fact, the Malays normally store their own domestic padi supplies for the year in bulk in large wooden boxes or stores specially constructed of bark or other materials and protected from rain and rats, and though such stores rarely exceed some 2,000 gantangs of padi in capacity, they indicate the possibilities in the direction of bulk storage. Further information on local padi storage is given in the article by W. N. Sands in this number.

Another problem which requires investigation is that of artificial drying, as opposed to sun drying which is precarious and excessive in its demands on space and on labour; there does not appear to be any material reason why artificial methods cannot be as successfully applied to padi as they are to maize and wheat in large producing countries.

The absence of such methods of drying padi in large rice producing countries can only be attributed to the fact that in most of those areas harvesting is conducted, normally, in very dry weather so that the padi is already sufficiently dry before purchase, but in this country the weather is often unreliable and the atmosphere is always fairly moist.

A combination of artificial drying with bulk storage would reduce handling costs and considerably ease the question of drying and storing space in the construction of milling units.

Another point in connection with the establishment of new mills is that the purchase of padi for milling requires an efficient and experienced buying organisation, for it is a business which is open to serious abuses which are liable to lead to material losses.

In existing areas padi purchase is carried on mainly by middlemen on a commission basis with fairly satisfactory results. There are a few areas, however, in which Co-operative Societies engage successfully in the business of padi purchase and there is immense scope for further development in this direction which has much to commend it.

Finally, the importance of grading grain both before and after milling must be stressed since quality depends very largely on the amount of attention which is given to this operation and without the adoption of high grading standards locally milled rice cannot compete with the imported article.

THE CHARACTERISTICS OF MALAYAN MILLED RICE.

BY

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While local rice production is being encouraged by every possible means, the question of the suitability of locally produced rice must not be overlooked. It is patent that if the industry is to flourish, locally produced and milled rice must be able to compete in quality as well as in price with the imported article, since it is becoming increasingly evident that the Chinese and Indian rice eating population will not agree to the substitution of an inferior home-grown article for the imported one to which they are accustomed. This applies with particular force to the Chinese section of the population who demand rice of the highest quality.

Lack of evidence regarding the quality of the produce of local mills in comparison with imported rices indicated that a survey was desirable and, in accordance with the suggestion of the Director of Agriculture 34 representative samples were obtained from practically all the larger mills in the country through the Agricultural Field Officers while, for comparison, 20 commercial samples of imported rice were obtained from local stores. A preliminary examination of the samples showed that a good product can be milled locally, a few samples being of quite good quality. The samples were submitted to tests for moisture content, percentage of broken rice, volume-weight ratio, uniformity of grain, cleanliness and colour; the results are shown in the Table below which was compiled with the assistance of the Agricultural Chemist who analysed the samples for moisture contents.

As regards moisture content, little comment is necessary since, with four exceptions, all the samples were sufficiently dry in comparison with similar samples of imported rice. This is shown in Table II in which the figures of Table I are summarised. Table II also shows that there is little variation in the volume-weight ratio, the mean weight per bushel for all rice groups being 64.9 lbs.

In the white rice groups the percentages of broken rice show extremely wide divergence ranging from 1 per cent. in Siam No. 1 rice to 31.1 per cent. in Rangoon rice. Local white rice compares very favourably with Rangoon white in this respect, but both these classes differ significantly from the Siam rices which are practically unbroken.

TABLE I.

No.	Type of rice	Quality	% moist	% broken	Grain type	Clean- liness	Colour
1	White Rice	1	11.2	52.5	mixed	clean	yellow
2	ditto	1	10.4	13.6	mixed	dirty	yellow
3	ditto	1	11.0	19.2	little mixed	clean	yellow
4	ditto	1	11.4	31.5	very mixed	clean	yellow
5	ditto	1	10.2	18.8	mixed	clean	yellow
6	ditto	1	11.5	4.8	little mixed	clean	yellow
7	ditto	1	12.1	22.8	little mixed	clean	yellow
8	ditto	1	11.0	23.2	very mixed	dirty	yellow
9	ditto	1	11.0	21.7	little mixed	clean	yellow
10	ditto	1	11.4	7.6	little mixed	clean	yellow
11	ditto	1	12.9	19.4	pure	clean	yellow
12	ditto	1	13.2	5.2	pure	clean	yellow
13	ditto	1	10.5	16.9	mixed	clean	yellow
14	ditto	2	11.6	20.2	very mixed	clean	yellow
15	ditto	2	10.6	21.1	little mixed	clean	yellow
16	ditto	2	10.0	24.9	mixed	dirty	yellow
17	ditto	2	11.5	19.0	mixed	dirty	yellow
18	ditto	2	9.8	26.5	mixed	dirty	yellow
19	ditto	2	11.3	23.0	very mixed	dirty	yellow
20	ditto	2	9.8	32.9	little mixed	clean	yellow
21	ditto	2	10.6	19.1	little mixed	clean	yellow
22	ditto	2	9.7	21.3	very mixed	dirty	yellow
23	Siam Rice	1	9.0	1.8	pure	clean	white
24	ditto	1	9.9	0.1	pure	clean	white
25	ditto	1	10.0	1.0	pure	clean	white
26	ditto	1	10.9	1.2	pure	clean	white
27	Siam Rice	2	10.2	1.8	pure	clean	white
28	ditto	2	8.6	1.4	pure	clean	white
29	ditto	2	8.8	2.9	pure	clean	white
30	ditto	2	9.8	1.5	pure	clean	white
31	Rangoon White	1	10.3	22.4	pure	clean	white
32	ditto	1	11.3	21.4	pure	clean	white
33	ditto	1	11.1	26.3	slightly mixed	clean	white
34	ditto	1	9.9	25.9	pure	clean	white
35	Rangoon White	2	10.8	33.6	slightly mixed	dirty	white
36	ditto	2	11.8	18.1	slightly mixed	clean	white
37	ditto	2	10.8	36.1	mixed	dirty	white
38	ditto	2	11.3	36.8	slightly mixed	dirty	white
39	Local						
	Parboiled	1	8.4	13.1	mixed	clean	brown
40	ditto	1	9.7	20.8	mixed	clean	brown
41	ditto	1	9.6	8.4	very mixed	clean	brown
42	ditto	1	10.1	12.5	mixed	clean	brown
43	ditto	1	9.5	8.2	mixed	clean	brown
44	ditto	1	12.8	17.4	very mixed	clean	v. brown
45	ditto	1	10.1	9.7	mixed	clean	brown
46	ditto	1	9.6	7.6	pure	clean	v. brown
47	ditto	1	9.9	2.8	little mixed	clean	brown
48	ditto	1	9.5	9.8	little mixed	clean	pale
49	ditto	1	9.6	10.3	little mixed	clean	brown
50	ditto	1	8.5	14.6	little mixed	clean	brown
51	Rangoon						
	Parboiled	1	9.2	8.6	pure		
52	ditto	1	11.5	7.2	little mixed	dirty	brown
53	ditto	1	10.0	7.1	pure	dirty	brown
54	ditto	1	8.9	12.2	pure	dirty	brown

TABLE II—Summary of Table I.

Type of rice	Quality	No. of samples	Per cent. Moisture	Per cent. Broken	lbs. per bushel
Local white ...	1	13	11.4	19.8	64.9
ditto ...	2	9	10.5	23.1	64.9
Siam White ...	1	4	10.0	1.0	64.6
ditto ...	2	4	9.2	1.9	64.4
Rangoon White ...	1	4	10.6	24.0	66.5
ditto ...	2	4	11.2	31.1	65.3
Rangoon Parboiled ...	1	4	10.0	8.8	64.3
Local ditto ...	2	12	9.8	11.3	64.6

The standard set by the Siam rices indicates uniformity in type of grain, careful milling, grading and cleaning, so that the product, consisting of uniform grains, being free of dirt and white in colour, is attractive in appearance compared with other rices.

On the average, No. 1 quality local white and No. 1 Rangoon white rices are fairly clean but the second quality in each of these classes is distinctly dirty. All the local white rices are inclined to be yellowish and appear to be undermilled by comparison with the Siam rice which is white and, though from a nutritional point of view this may be an advantage in local rice, from the view point of market value it constitutes a serious drawback which can only result in reduction in price, at least as far as the Chinese section of our population is concerned. Variation in the parboiled group of rices is much less marked than with the white rices, local parboiled having 2.5 per cent. more breakage than the Rangoon product, though all the local parboiled rices tend by comparison to show a darker colour than the imported article, the colour being probably due to undermilling or to some defect in the parboiling process.

In both the white and parboiled groups local rice appears to be derived from mixed padi as compared with imported rice in which mixture of types of grain is much less apparent. This is more or less what must be expected when due regard is given to the different conditions under which the padi is grown. In Siam and Burma, areas are immense and rice cultivation has been the main occupation of the people, as well as their chief industry for very many years, so that standards have been achieved such as do not yet exist in Malaya.

In Kedah and the north of Province Wellesley some of the mills, situated in the midst of large padi producing areas, turn out good quality marketable rice so that it is evident that a high grade article is not impossible of attainment.

Thus, samples Nos. 6, 10 and 12 in Table I are of good marketable quality by comparison with the majority which lack uniformity in grain size and show a high percentage of broken rice. In the mills which produced these samples it has been reported that the padi is graded prior to milling, that particular attention is given to the milling processes, and that the final product is carefully separated to reduce the percentage of broken rice to a minimum and thus ensure a high grade No. 1 quality rice.

If similar attention in milling, and in particular to grading, could be given in all local mills the quality of the product would be greatly enhanced. At the present time, the considerable demand for cheap rice has probably influenced the quality of local rice detrimentally.

THE STORAGE OF PADI IN KEDAH.

BY

W. N. SANDS,

Principal Agricultural Officer, Kedah.

There is an old established custom among Malay padi-planters to store sufficient padi to supply food for home-use over a period of at least one year. During the past three seasons of bountiful crops increased attention has been given in Kedah to the storage of padi, in excess of domestic requirements, and which would normally be sold to millers, and others, as soon as possible after harvest.

The rush to sell padi at harvest time has in the past led to lower prices and, when padi was assembled in large lots at convenient centres, the current depressed price was paid, but if padi was purchased in small scattered lots the price was still further reduced by about 10 per cent., this was due to the extra cost of collection and transport, and also to some extent to the newly reaped padi being insufficiently dried.

Prices, as a rule, were considerably higher from planting time onwards, say six months or so after harvest. In 1933, for example, the price paid for padi by Chinese millers in August was no less than 50 per cent. higher than in January. The fact that higher prices could be expected if padi was kept in storage for some months following harvest led to efforts being made to form societies, or to use the existing Co-operative Societies, for the purpose of storing padi and financing planters who sent padi for storage.

Large quantities of padi are generally disposed of, prior to harvest, to persons from whom the growers had obtained cash, or goods. This padi is known as 'padi kuncha' and the usual rate of advance of cash, or goods, for such padi in 1933, was \$4 to \$5 per kuncha (160 gantangs), and under the agreement one kuncha of padi had to be handed over at harvest for every \$4 to \$5 advanced. The system is a pernicious one which the Co-operative Societies and others are doing their best to counteract. The storage schemes which have been started and are now described will, it is hoped, render much assistance in future in this direction.

Smaller amounts of padi are also sold in the villages, but the bulk of the surplus, in the absence of ready cash or storage facilities, has to be sold early to local Chinese millers or to middlemen for shipment to Penang and elsewhere.

The Storage Societies which hold padi for six to nine months whilst waiting for a more favourable market can be grouped under two heads:—

- (a) those arranged by private enterprise and
- (b) those worked in connection with rural Co-operative Societies and confined to members of these Societies.



A LARGE GALVANISED-IRON GRANARY.



SMALL GALVANISED-IRON "JELAPANG".



JELAPANG BUILT OF LOCAL MATERIALS.



JELAPANG OF LIGHT CONSTRUCTION.

The working details of each group are similar in most respects. Briefly stated, they are, that any quantity of padi can be sent for storage, except 'padi kuncha', referred to above, which is refused. All padi must be thoroughly dry, clean and sound and of a good milling grade. The grade preferred, because it realizes the highest prices, is the medium long Radin type such as produced by the varieties 'mayang ebus', 'reyong', 'Radin China' and 'to' seman'.

Storage facilities are arranged for by the Societies, either in their own or rented stores. For every 160 gantangs (one kuncha) of padi sent for storage, 16 gantangs (one naleh) in addition are contributed to provide for loss in weight and volume and also to cover the proportional cost of the rent of the stores and handling charges.

If the members of a Society own a store, or stores, 8 gantangs only ($\frac{1}{2}$ naleh) are contributed for depreciation, but for non-members the full rate is charged. Should any member require an advance against his padi in store for the preparation and planting of his land for the next crop he can obtain the advance based on current price which this year was at the rate of \$10 per kuncha stored. Should he be a member of a Co-operative Society and his padi sells for more than the sum named, his account is credited with the proportional share of the profits.

At times private Storage Societies do not make a charge for depreciation, but arrange for storage, sell at what is considered to be an opportune time and divide the proceeds, *pro rata*, among the contributors of padi, less the cost of working expenses.

It will be realized from the foregoing that the organisation and working of storage schemes are quite simple in operation. It is necessary, however, to collect accurate information before, or at harvest, as to the quantity of padi to be stored, either temporarily or for several months. Unless this information is available, considerable difficulty may be experienced in arranging accommodation. Also, it is essential for success that members must be loyal to their Society and refrain from demanding the return of their padi once it is stored. In special circumstances, however, for example when padi is urgently required for sale in a village owing to a shortage of food, it may be released.

The chief types of stores are known as 'jelapang' and 'kepok' respectively; the former is usually a fairly large, solidly built structure and the latter a small one of much lighter construction.

All padi is stored in bulk no matter what type of store is used.

Description of 'Jelapang'.

The 'jelapang' type is usually a rectangular, oblong granary raised on posts 2 to 3 feet from the ground. The posts may or may not be set in concrete. The timber used in construction is generally 'meranti', 'chengai' or 'tembusu',

the latter being preferred on account of its very durable qualities. The floors are of wood and the walls of galvanized-iron sheets, planks, or closely interlaced split-bamboo.

The span-roof is covered with galvanized-iron, or 'attap'. The single door is usually composed of loose planks placed horizontally above each other and removable vertically and singly when padi is being dealt with.

When galvanized-iron is used for the walls the inside of the building is lined with boards, or mats, prior to filling the store with padi. There is no outside grain-door at the base, so, necessarily, all unloading is done from the inside and from the top of the heap.

Plate I, No. 1 shows a large galvanized-iron granary $30\frac{1}{2}$ feet long, $15\frac{1}{2}$ feet wide and 10 feet high from floor to wall-plate. This building will hold from 30,000 to 40,000 gantangs of dry padi. The cost of the store could not be ascertained.

A smaller store, also built of galvanized-iron, is shown in Plate I, No. 2. In this, the galvanized-iron sheets are placed inside the supporting uprights and cross-beams. The measurements of this store are 8 feet long, 5 feet 6 inches high to the wall-plate and 5 feet 5 inches wide. This was built at a cost of \$80 and will hold about 1,900 gantangs of grain.

The commonest type of 'jelapang' is that built of wood with interlaced bamboo walls and an 'attap' roof. The gable-ends of the roof are protected from the weather by screens made of planks, 'attap', or 'bamboo'. The bamboo used for the walls is the 'buloh duri' (*Bambusa Blumcana*, Schule). This bamboo is also employed for the small cylindrical store known as 'kepok' and can withstand the attacks of insects and rats better than any other species. It also, has the advantage of being more durable.

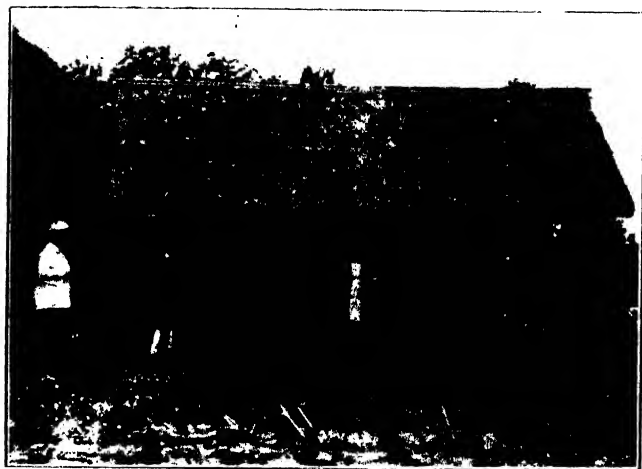
The 'jelapang' shown in Plate II, No. 1, is 13 feet 8 inches long, 8 feet 5 inches wide and 5 feet 8 inches to the wall-plate. The cost was estimated at \$150 and it holds between 4,000 to 5,000 gantangs. Except for the renewal of 'attap' every 7 or 8 years, it is said that the store can last for at least 50 years.

Plate II, No. 2, shows a store of similar type, but of cheaper and lighter construction; this is 12 feet long, 6 feet 5 inches wide and 5 feet 6 inches to the wall-plate. This type holds about 3,000 gantangs of padi. Its cost was \$60 and it is expected to last for 30 years or more.

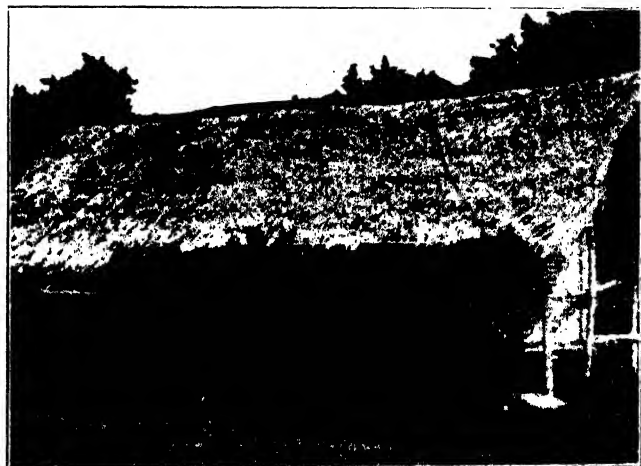
As both large and small 'jelapang' are built along similar lines, there is no need to describe others of different dimensions.

The 'jelapang' constructed of wood, bamboo and 'attap' is favoured on account of its low cost and also because the materials required for its construction can be readily obtained locally.

Only when the stored padi is insufficiently protected on top do losses occur on account of pests, but these losses are small. There is, naturally, some loss in weight which varies with the length of period of storage, but this was found to be about 2 per cent. in one large lot of 85,000 gantangs stored in 'jelapang' for 9 months in 1933.



SMALL STORE WITH TWO BINS (KEPOK)



SMALL STORE WITH THREE BINS (KEPOK)

Kepok.

The cylindrical bin known as 'kepok', is the common family grain-store, and it often forms a useful adjunct to the 'jelapang'. The 'kepok' is constructed of wood and split bamboo with an 'attap' shed, or span roof. The bamboo used is the 'buloh duri' referred to above. The bin is of light construction throughout and can be readily transported from place to place if necessary. From one to three bins are assembled under one shed.

In Plate III, No. 1, where two 'kepok' are shown under one roof at a height of 2 feet above ground; each bin is 12 feet 4 inches in circumference, 3 feet 5 inches high and can hold 250 gantangs of padi.

In Plate III, No. 2, the circumference of each of the three bins is 18 feet with a height of 4 feet, and each can contain 640 gantangs of padi.

A 'kepok' made of interlaced bamboo, with boards at the base, costs from \$3.00 to \$4.00 according to size. In some cases split bamboo covered with padi straw is used for the floor which reduces the cost of construction still further. The light covering shed built of poles and 'attap' costs about \$2.00 per 'kepok'. These small stores last from 8 to 10 years.

It will be seen that satisfactory padi stores can be readily constructed of local materials at small cost and large quantities of padi stored in them successfully for several months: there is, therefore, no reason why a considerable extension of padi storage in villages and small towns, should not be undertaken for the benefit of local padi planters.

Quantities of Padi Stored by Societies in 1933.

It was not possible to obtain complete information concerning the amount of padi stored for some months and afterwards sold, but the following details of padi stored by one large, private Society and seventeen, small, rural Co-operative Societies in 1933 are of interest and serve to indicate the lines along which storage schemes may be profitably developed.

In the Kota Star district a private Society, with over 600 members, stored and sold 85,600 gantangs (38.2 tons) of padi. The sale price was $7\frac{1}{2}$ cents, per gantang, as against 5 cents per gantang offered at harvest.

Seventeen rural Co-operative Societies undertook storage for their members, and 513 members contributed 83,200 gantangs (37.1 tons). This padi was sold some months later at market price.

Considerable quantities of padi are often stored by private owners, but only people who can afford to wait for better prices are able to do this, whereas the raiat can rarely be sure of obtaining full market value for his padi unless he can store it with a properly organised Society or Association of growers.

Acknowledgment.

I am indebted to the Assistant Principal Agricultural Officer (H.H. Tunku Yacob) and the Registrar of Co-operative Societies (Che Abdul Rahman) for the information supplied concerning the storage of padi by Societies, and to Mr. N. H. Sands for the photographs illustrating this article.

MALAYAN PADI COMPETITION.

BY

F. W. SOUTH,
Chief Field Officer.

For many years padi classes have formed an important section at District Agricultural Shows and at the Annual Exhibitions of the Malayan Agri-Horticultural Association. The objects of the padi classes at the Shows were to stimulate interest in padi planting and to increase the production per acre by encouraging the planting of high yielding types of padi.

Exhibits in the past have consisted of small samples of padi, one quart each, without any attendant information regarding the size of the holding on which it was reaped or the yield obtained. These exhibits were sent in large numbers to District Shows and in even larger numbers to the Annual Exhibition. It was felt, as a result of experience, that this system did not provide the best means of progress and enabled, as had actually occurred, a small plot of padi grown in a school garden to receive the highest award for padi in Malaya.

The Director of Agriculture drew attention to this position in a memorandum submitted to the Committee of the Malayan Agri-Horticultural Association and to officers of the Field Branch of this Department. He pointed out that the points which required to be taken into consideration were:—

That samples sent to the Annual Exhibition should be larger in size.

That they should be fewer in number and should be the result of some preliminary selection.

That they should bear some relationship to the area cultivated and the yield obtained.

He suggested that one way of overcoming the existing difficulty would be an organisation by means of which the Annual Exhibition should represent the culminating point of an all Malayan Padi Competition. He then gave the following outline of the type of organisation which he contemplated.

In each district the District Officer should be asked to arrange in conjunction with the Agricultural Field Officer to collect entries for the competition. This could be done by mukim, the Penghulu of each mukim being in charge of the collection of entries. The entries would be completed by a certain date and then there would be held in each district a padi show at which each competitor would be required to display at least 4 gantangs of padi, each sample to be accompanied by a statement of the area on which the padi was cultivated and a certificate of the yield obtained given by the Penghulu. Such District Competitions could be held in conjunction with local agricultural shows where they are held, but if no general show takes place a special padi show could be arranged.

As the result of each district competition, the best samples from each mukim would be selected for despatch to the Central Show in Kuala Lumpur, each sample as before being accompanied by the certificate as to acreage and yield. In addition the samples from each district should be accompanied by a certificate from the Agricultural Field Officer stating the average yield of padi for the whole of a particular district as revealed by departmental computation. It seems not improbable that in order to make the system a success additional awards would be required for the District Padi Shows. These awards might take the form of either bronze medals or certificates either given by the Malayan Agri-Horticultural Association or by the Agricultural Department. The Director of Agriculture thought that if a system of this description could be worked out for the whole of Malaya it would give the necessary impetus to padi competitions at shows which they at present lacked.

These proposals were submitted to the Agricultural Conference held in August, 1933, and were strongly supported by a Committee of the Conference appointed to consider the scheme. The scheme was also considered and accepted by the Committee of the Malayan Agri-Horticultural Association and by them was submitted to the Governments of the Straits Settlements, the Federated Malay States and each of the Unfederated States. These Governments were asked if they approved the general outlines of the scheme and would be prepared to put it into operation after the coming padi harvest. The replies received were on the whole favourable.

As a result of recommendations made during the consideration of the scheme Rules for a Malayan Padi Competition were drawn up, and are given below. Copies of these Rules have been forwarded to the Governments concerned and steps are being taken to hold the first Competition after the forthcoming padi harvest.

There are a few points in the Rules on which a short comment or explanation is desirable. Thus in Rule 4 it should be explained that the strains of padi approved by the Agricultural Field Officer for entry in each District Competition will not be confined entirely to those pedigree strains selected by this Department which are best suited to the district, but will also include any well known variety popular and widely grown in the district, as for example, Mayang Ebos, Radin Che Mah and Radin China in Kedah where selection work on these varieties is still in progress, Manik Siam, Anak Naga, Nalung and other varieties in Kelantan, and Padi Acheh in several districts in the Federated Malay States.

The Local Shows may be organised for the whole of an administrative district, or in districts containing a large area of padi land such as Krian, two or three Local Shows may be considered preferable in order to ensure the interest and attendance of the local padi cultivators.

While the Malayan Agri-Horticultural Association and this Department are prepared to provide bronze medals and certificates as prizes at Local Shows, the organisers are left free to present any other prizes which they may consider suitable.

MALAYAN PADI COMPETITION.

Rules.

1. The Malayan Padi Competition shall be organised in two parts—

Part I	—	The Local Competitions.
Part II	—	The Central Competition at the Association's Annual Exhibition in Kuala Lumpur.

Part I. Local Competitions.

2. Each Local Competition shall be organised jointly by the District Officer and the Agricultural Field Officer of the Circle, State or Settlement in which the district is situated.

Entries.

3. Each intending competitor shall notify the District Officer or his representative, for example the Penghulu of his mukim, of his intention to enter for the competition not later than a date to be notified by the District Officer.

4. Before the commencement of the competition the Agricultural Field Officer for the Circle, State or Settlement shall furnish the District Officer with a list of strains of padi approved for entry in the competition. No padi will be accepted for entry unless it is of one of the approved strains.

5. Each exhibit entered for the competition shall be taken from an area of not less than $\frac{1}{2}$ acre planted with the particular strain exhibited.

6. Each exhibit shall consist of 3 gantangs of padi and shall be delivered at the place appointed for the Local Padi Show on the date fixed by the District Officer for the receipt of exhibits.

7. Each exhibit must be accompanied by the entry form to be obtained either from the District Officer, the Agricultural Field Officer for the Circle, State or Settlement, the Penghulu of the mukim, the Malay Agricultural Assistant, or the Malay Agricultural Subordinate for the district or locality.

8. On the entry form shall be shown—

- (i) The name of the Competitor.
- (ii) The locality of the holding and if possible the lot number.
- (iii) The size of the area from which the padi entered for competition was drawn.
- (iv) The strain of padi entered.
- (v) The yield of padi in gantangs harvested from the area under (iii).

9. Each entry form shall bear a certificate signed by the Penghulu of the Mukim or a Malay Agricultural Assistant or Subordinate to the effect that the statements made on the entry form in accordance with Rule 8 are correct; and

also a statement of the average yield of padi in gantangs per acre, relong or orlong for the mukim as officially determined.

Time and Place of Local Show.

10. The Local Show shall be held at such time and place as the District Officer may arrange.

Appointment of Judges.

11. Exhibits shall be judged by judges appointed by the District Officer.

Judging Exhibits.

12. In judging exhibits the data set out on each certified entry form shall be taken into consideration in addition to the merits of the actual sample to which it refers.

Prizes.

13. In each local competition prizes shall be awarded to the three best exhibits, but the judges shall at their discretion be entitled to award additional prizes and certificates.

Disposal of Exhibits.

14. At the conclusion of each Local or District Show the prize winning exhibits together with certified entry forms relating thereto will be retained by the Agricultural Field Officer of the Circle, State or Settlement for despatch to the Association's Annual Exhibition in Kuala Lumpur. Such exhibits so retained will be paid for by the Association at three cents per gantang above the standard market price for padi in the district or locality and will become the property of the Association. All other exhibits will be handed back to their owners or disposed of as the owners may direct at the conclusion of the Local Show.

Part II. Central Competition.

15. On a date to be fixed by the M.A.H.A. each Agricultural Field Officer shall despatch to Kuala Lumpur at the expense of the Association all winning exhibits collected from the District Competitions in his Circle, State or Settlement, together with the certified entry forms in respect thereof. He shall not state what prize was awarded to each exhibit in the Local Competitions and shall see that the entry forms do not convey this information.

16. These exhibits shall be displayed in the Section devoted to padi at the Association's Annual Exhibition in Kuala Lumpur. The assembled exhibits shall be judged in accordance with the standards of the Association, but there

shall also be taken into account the particulars furnished on the certified entry forms.

17. The Judges for the Padi Section shall be appointed by the Association.

18. Prizes shall be as follows :—

- | | | |
|--------------|---|---|
| First Prize | — | A Diploma of Merit, the sum of \$25, a Gold Medal, and a Challenge Trophy to be retained by the winner until the competition in the ensuing year. |
| Second Prize | — | A Diploma of Merit, the sum of \$10, and a large Silver Medal. |
| Third Prize | — | A Diploma of Merit, the sum of \$5, and a Silver Medal. |
| Fourth Prize | — | A Diploma of Merit, and a large Bronze Medal. |
| Fifth Prize | — | A Diploma of Merit, and a Bronze Medal. |
| Sixth Prize | — | A Diploma of Merit. |

The judges shall be empowered to award additional prizes and certificates of merit at their discretion.

Selected Article.

THE WORLD RICE SITUATION.*

World rice production in the past decade has shown two very marked upward movements—in 1924-25 and 1930-31—with a less notable rise in 1928-29. In 1931-32, however, there was a pronounced fall in production. The data now available, which cover countries accounting in 1931-32 for about 93 per cent. of the world total excluding China, for which no reliable statistics exist, point to a continuance of the decline in 1932-33 though to a moderate degree, the percentage fall in the past season amounting to about 1 per cent.

World Production of Rough Rice†.

(*Million pounds*).

1931-32	...	...	...	194,735
1930-31	...	...	...	201,680
1929-30	...	...	...	188,760
1928-29	...	...	...	192,420
1927-28	...	...	...	184,241
1926-27	...	...	...	185,013
1925-26	...	...	...	185,299
1924-25	...	...	...	186,864
1923-24	...	...	...	172,733

† Not including that of China, Turkey and Persia.

In the past season there were considerable increases of production in Burma and in Siam, while that of French Indo-China appears to have remained practically at the same level, the decrease in Cochin-China being balanced by the increase in Annam; in Korea, Formosa, Japan and the Netherlands East Indies there were also increases. On the other hand there was a very great fall in production in India excluding Burma, the effect of this on the total being an indication of the critical part played by the area in determining the variation of world production as a whole. The variation of production in the principal producing countries, with the possible exception of French Indo-China, where the total has in the last few years remained relatively stable, and of Formosa, where there has been a continued increase, has been the reverse of that of the previous season.

Even without taking into account the very large but statistically unknown production of China, 94 per cent. of the world's total in the quin-quennium ending 1931-1932 was produced by the countries of monsoon Asia. Similarly, all but a relatively small proportion of the rice entering into international trade also originates in monsoon Asia, the principal surplus-producing countries being Burma (principally Lower Burma) French Indo-China (principally Cochin-China), Siam (almost entirely the five inner circles), Korea and Formosa. Since the two last-named countries supply principally Japan and form with that country practically an economic unit, the supply situation on the world market depends principally on the crops of Burma, French Indo-China and Siam.

* By C. J. Robertson, in *International Review of Agriculture*, Year XXIV, No. 6, June, 1933.

Unless otherwise stated all data have been converted to terms of milled rice and derivatives the latter including broken rice and white flour or meal but not bran.

The Situation in the Three Great Surplus Producing Countries.

Despite the countenance of low prices there was in the past season a recovery in the area under padi in Burma, though the maximum of 1930-31 was not regained. Production, which in the past decade has, with the exception of 1931-32, when a reduction in area coincided with a weak monsoon, fluctuated only slightly about the level of 12,000 million pounds, increased by 17 per cent. in the past season.

The increase in area in the past season took place particularly in Lower Burma, from which the bulk of the export is derived. Production in 1932-33 increased, thanks to the increase in area and to favourable weather, and the final estimate of the surplus available for export (that is the exports in the year beginning in the middle of last December) showed an increase of 28 per cent. on the very small figure of the previous season. As total exports in 1932 amounted to 6,326 million pounds while the final estimate of the export surplus from the 1931-32 crop was only 6,048 million pounds, there was presumably no carryover at the beginning of the present export season and domestic stocks were probably greatly reduced in 1932, so that the surplus estimated for the current year may be taken as a maximum; in any case, actual exports during the past ten years have been more often than not smaller than the surpluses as finally estimated.

Exports (mainly of milled rice) from Rangoon to foreign ports and to Indian ports, which together normally make up about three-quarters of the total export of Burma, in the period from 1st January 1933, a date only fifteen days after the beginning of the season, to 27th May, 1933 were respectively 1,535 million and 787 million pounds (against 1,970 million and 393 million in 1932), in all 2,322 million against 2,363 million pounds.

Production and Net Export of Major Exporting Countries.

(Million pounds of rice and rice derivatives).

Production				Year	Burma* to foreign countries	Net export to Indian ports		
Year	Burma	French Indo-China	Siam			Indo-China	French Siam†	
1932-33	12,142	8,364§	8,120‡	1933	—	—	—	—
1931-32	10,351	9,034	6,781	1932	4,218	2,107	2,624	3,379
1930-31	12,724	9,624	8,044	1931	4,323	3,177	2,101	2,683
1929-30	12,335	9,557	6,458	1930	5,187	2,015	2,465	2,315
1928-29	12,108	9,250	6,470	1929	3,930	2,269	3,229	2,625
1927-28	12,088	10,333	7,607	1928	3,379	2,856	3,904	3,500
1926-27	12,647	9,561	8,710	1927	4,383	2,414	3,630	3,708
1925-26	11,734	9,440	6,989	1926	4,621	1,457	3,506	2,780
1924-25	12,536	9,241	8,236	1925	4,805	2,754	3,277	2,947
1923-24	10,309	8,334	7,332	1924	4,138	1,042	2,646	2,278

* The official data are for rice both in the husk and not in the husk but, as practically all the rice exported is milled, they have been taken to represent milled rice and derivatives.

† Exports from Bangkok, which make up 98 per cent. of the value of the total rice exports from Siam. Data refer to the season from 1st December to 30th November.

§ Not including Cambodia.

‡ Provisional estimate.

Production in French Indo-China has fluctuated in the last decade between 9,000 and 10,000 million pounds. The export originates mainly in Cochin-China, which produces about one-third of the total. Rather less favourable conditions during the period of transplanting outweighed the increase in area in this region. The export surplus from the past crop is considered to be smaller than that from the 1931-32 crop; the most recent estimate places the surplus for export from Saigon during the present year at 2,464 million pounds, 291 million smaller than in 1932. Actual exports in the first three months of 1933 showed an increase of 13 per cent. on those in the corresponding period of 1932.

Production in French Indo-China.

(Million pounds of rice and derivatives).

Year		Cochin-China	Cambodia	Tonkin	Annam	Laos
1932-33	...	3,267	—	2,892	1,642	563
1931-32	...	3,636	781	2,903	1,183	531
1930-31	...	2,985	1,446	3,220	1,442	531
1929-30	...	3,484	1,047	2,990	1,505	531
1928-29	...	3,405	976	2,849	1,473	547
1927-28	...	3,876	1,273	3,013	1,543	628
1926-27	...	3,405	1,448	2,211	1,918	579
1925-26	...	3,240	1,179	2,923	1,535	563
1924-25	...	3,565	902	2,521	1,770	483
1923-24	...	3,314	927	1,801	1,646	644

In Siam, as in Burma and, to a much less extent, in French Indo-China, there was an increase in the area of rice harvested in the past season, amounting in this case to 8.5 per cent. Production increased more than proportionately, namely by 20 per cent. The final estimate of the exportable surplus is 3,942 million pounds, which is over double the small export surplus of the previous season. Actual exports from Bangkok in the first four months of the export season were larger than those in the corresponding period of the last season.

The Situation in the Minor Exporting Countries.

While their total production is relatively insignificant as compared with that of the great Asiatic producers, certain of the minor producing countries have special importance on the European and other markets where a demand for high-quality rice exists.

Amongst these producers of high-quality rices the most important are the United States, Italy and Spain.

There was a pronounced fall in production in the United States in 1932-33 and a slight fall in Italy, but in Spain production rose almost to the 1926

maximum. In the last-named country the increase in production, amounting to 19.5 per cent. with respect to 1931, was due in part to increase in area, which amounted to 8.6 per cent., but still more to favourable growing conditions. In the United States there was a general reduction in area and in three Southern States (Louisiana, Texas and Arkansas) unfavourable weather also played a part in reducing production to a figure 14.5 per cent. below that of 1931 and 9.0 per cent. below the average for 1926 - 30. In Italy a reduction in area under the crop was outweighed by conditions on the whole favourable to growth.

Amongst other minor producers of relative importance Egypt had in the past season a production much above the five year average, thanks to the abundance of irrigation water, which enabled the Government to authorize an area under the crop over seven times the greatly reduced area of the previous year.

Production and Net Export of Minor Producing Countries.

(Million pounds rice and derivatives).

Year	Production			Year	Net export		
	Italy	Spain	U.S.A.		Italy	Spain	U.S.A.*
1932 ...	1,057	491	1,240	1933 ...	—	—	—
1931 ...	1,066	411	1,449	1932 ...	335	87	270
1930 ...	1,084	482	1,415	1931 ...	327	83	237
1929 ...	1,016	452	1,279	1930 ...	456	125	252
1928 ...	1,120	448	1,368	1929 ...	379	86	376
1927 ...	1,094	478	1,410	1928 ...	413	131	286
1926 ...	1,013	494	1,338	1927 ...	561	118	251
1925 ...	951	472	1,047	1926 ...	430	142‡	60
1924 ...	838	456	1,015	1925 ...	333	99	68
1923 ...	747	374	1,062	1924 ...	387	116	165

* August July.

‡ Net import.

Exports from Italy, which in 1932 showed a decline of 3 per cent. for milled rice and of 11 per cent. for brown rice, declined further in the first quarter of 1933 with respect to the same period of last year by 56 per cent. and 35 per cent. respectively. Exports of rough rice on the other hand, increased about 8½ times in 1932 and over three times in the first quarter of 1933. In Argentina which is the most important foreign market for Italian rice, there is reported to have been a great increase in the area harvested. Exports of milled rice from Spain increased by 4 per cent. in 1932, the decrease in takings of the United Kingdom and Cuba, the two leading markets, have being outweighed by the increase in those of France and certain other countries. Exports of milled rice from the United States, which go principally to the United Kingdom

and Germany, declined by 27 per cent. in the first quarter of 1933 with respect to the corresponding period of 1932.

The relatively large export from Egypt in 1932 in comparison with previous years, which may be expected to be repeated this year, irrigation water in that country being again abundant, will accentuate competition in the Levant and the Balkan countries.

Exports from Brazil, the principal South American country with a surplus, which are directed chiefly to Argentina, Uruguay and Germany, were in 1932 less than one-third of the record figure of 1931; in the first three months of 1933 they were 88 per cent. below the figure for the corresponding period last year. British Guiana, which has a growing export surplus, is finding difficulty in its principal market, the British West Indies, owing to the competition of Burma rice.

Conditions in the Principal Rice-Importing Countries.

Production in India (excluding Burma), which is the world's greatest producer of rice with the possible exception of China, for which no reliable data are available, fluctuates very markedly depending on the character of the monsoon. In 1931-32 production attained the maximum of 71,262 million pounds rice and derivatives, area having been increased by 2.6 per cent. and rainfall having in that year been unusually favourable over the greater part of the area. In 1932-33, however, there was a reduction of 3.3 per cent. in area and rainfall was not so uniformly satisfactory. In Bihar and Orissa, which is normally second to Bengal amongst the provinces of India as a producer, the decline in production was no less than 26.8 per cent. below the level reached in the previous season. The deficit regions of India as a whole derive the bulk of their supplies from Burma. The relative shortage in India this year is reflected in the fact that coastwise imports from Burma up to 27th May amounted to 787 million pounds against 393 million up to the corresponding date in 1932.

As regards China, information is as usual somewhat vague; it is reported that the 1932-33 crop was above average and probably about the same high level as that of 1930. In this case it may be expected that imports in 1933 will fall from last year's high figure to the low level of 1931. In fact, imports in the first quarter of 1933 were 25 per cent. smaller than those in the corresponding period of 1932.

Amongst the importing countries of the second rank, the Netherlands East Indies have in the past five years taken the first place. Imports into Java and Madura fluctuate considerably from year to year, depending on the size of the domestic crop; production in 1932-33 was larger than that of the previous year and than the average of the five years ending 1930-31. For the Outer Provinces data of production are not available but it is known, that owing to the concentration of the natives on export crops and to the rapid increase of population comparatively few areas have normally a surplus. Imports into these Provinces are larger and more uniform than those into Java and Madura. In

Production in Certain Provinces in India.

(Million pounds rice and derivatives).

Year		All-India excluding Burma*	Bengal	Bihar and Orissa	Madras
1932-33	...	63,699	23,063	10,393	12,957
1931-32	...	71,262	23,483	14,198	13,322
1930-31	...	66,935	22,775	13,890	13,300
1929-30	...	64,686	20,292	14,872	13,001
1928-29	...	67,420	23,958	13,825	12,857
1927-28	...	57,764	16,064	10,832	12,576
1926-27	...	60,782	18,196	11,846	11,732
1925-26	...	64,311	20,331	12,095	13,167
1924-25	...	64,337	19,078	14,902	12,143
1923-24	...	59,453	18,587	12,118	11,210

* The all-India statistics exclude the production of the Punjab, the North-West Frontier Province, Ajmer-Marwara, Manipur, Pargana and certain other Indian States, which together produced 2,602 million pounds on the average of the five years ending 1930-31; they also exclude the production of the feudatory States of Bihar and Orissa, for which no reliable data are available.

the first quarter of this year imports into Java and Madura showed a decrease of 19 per cent. with respect of those in the same period of 1932; those into the Outer Provinces during the same period were practically the same as last year, there being an increase of 0.4 per cent. Imports into the Netherlands East Indies have been prohibited for the period from 21st March 1933 to 21st July 1933. This embargo will affect particularly Burma, the chief source of imports, but is also a serious blow to the export trade from Siam and Cochin-China. Rice may, however, be imported into the Sumatra East Coast and Celebes by licence, should these Provinces require such imports.

In British Malaya acute distress in the rubber and tin industries still dominates the situation in the Peninsula. This has not only greatly reduced the purchasing power in the country, both by a general lowering of the standard of living and by leading to the return to India of much immigrant labour, but has also lead to an increase in the area under rice; not only is there the stimulus to many who formerly earned a living from employment in the major exporting industries to engage in rice cultivation but serious efforts are being made by the Government to encourage rice-growing with a view to lessening dependence on export crops and assuring a domestic supply of foodstuffs. Yields in the past season were very satisfactory in several States and the crop was generally well above the average. Imports, which have shown a downward tendency in the past two years, were 11 per cent. smaller in the first quarter of this year than in the corresponding period of 1932. The decline in imports of Burma

rice, which is preferred by the immigrant Indian population, was proportionately greater. The falling off in this market affects principally, however, Siam rices, which take the first place in imports, largely owing to the taste of the Chinese population.

Net Imports into the Principal Asiatic Countries of Deficit other than India Proper and Japan.

(Million pounds rice and derivatives).

Year		China	Netherlands East Indies	British Malaya	Ceylon
1932	...	2,992	899*	921	1,024
1931	...	1,427	1,303	1,156	1,006
1930	...	2,647	1,357	1,392	1,064
1929	...	1,439	1,592	1,256	1,102
1928	...	1,683	1,257	1,177	1,093
1927	...	2,799	1,003	1,228	1,053
1926	...	2,489	1,292	1,068	1,033
1925	...	1,679	1,109	907	972
1924	...	1,759	906	880	884

* Not taking into account the relatively small export from the Outer Provinces.

In Ceylon, as in British Malaya, reduced employment on the plantations with consequent lower purchasing-power and stimulus to local rice production, has resulted in the last two or three years in a decline in rice imports. In the first four months of 1933 the decline in the total with respect to the corresponding period of last year was 14 per cent. This reduction has been felt less severely by Burma, the principal source of imports, than by Siam and Cochin-China, the quantities originating in the latter two countries being, however, small in comparison with those from India proper.

Japan rivals India proper in the quantity of its imports but, as it derives less than one-fifth of its total imports from foreign countries—the remainder being taken from its dependencies, Korea and Formosa—its importance on the world market is very small compared with that of India, China, British Malaya, Ceylon and the Netherlands East Indies.

Imports into Japan fluctuate within wide limits and generally inversely to domestic production. In recent years, as production in Korea and Formosa has increased, imports from foreign countries have been reduced. Production in the past season was 9.4 per cent. above that of last year and slightly below the five-year average. Korea, which is the principal source of rice imports, slightly increased its production despite a decrease in area, while in Formosa the first crop which is that exported to Japan, was a very large one, thanks partly to

Sources of Supply of Japan.
(*Million pounds rice and derivatives*).

Year	Production			Year	Net import of Japan		
	Japan	Korea	Formosa (first crop)		From foreign countries	From Korea	From Formosa
1932-33	19,020	5,079	1,322	1933	—	—	—
1931-32	17,346	4,999	1,143	1932	253	1,960	—
1930-31	21,063	6,041	1,094	1931	91*	2,385	723
1929-30	18,758	4,305	896	1930	287	1,318	497
1928-29	18,945	4,245	1,004	1929	384	1,439	521
1927-28	19,510	5,435	1,022	1928	474	1,816	567
1926-27	17,465	4,807	892	1927	1,278	1,440	642
1925-26	18,804	4,641	997	1926	748	1,459	578
1924-25	17,961	4,163	939	1925	1,671	984	567
1923-24	17,463	4,779	819	1924	1,073	1,132	—

* Net export.

increased area but mainly to favourable weather and to the energetic measures taken by the Government on behalf of rice-growing. Total production in Japan and its dependencies was almost exactly halfway between the very small figure of the previous season and the record high figure of 1930-31. Stocks are reported to be larger than last year. Government control over the rice trade has been strengthened. Taking all these considerations together it may be expected that imports from foreign countries will this year show a further decline. In fact, while gross exports were 2 per cent. larger in the first three months of the year than those in the corresponding period of 1932, net imports were 20 per cent. smaller. Thanks to treaty obligations Siam and the United States are the only foreign countries to retain any considerable share in the import into Japan; the imports from the former are by far the greater of the two and are mainly composed of broken.

The Principal European Importing Countries.

European imports make up roughly one-fifth of the total international trade in rice. By far the greater part of this rice is worked up in the European mills and much of it is re-exported, generally after milling.

Germany, the largest European importer, takes milled rice and unmilled rice in relative proportions varying from year to year, both principally from Burma. In 1932 the imports of unmilled rice, in that year the larger of the two, showed a decline of 4 per cent., while those of milled rice declined by 9 per cent.; exports of milled rice, which are very widely distributed, declined by 24 per cent., a still greater decline than that of the previous year. In the first four

months of 1933 there was a decrease of 6 per cent. in imports of unmilled rice and an increase of 11 per cent. in those of milled rice with respect to the corresponding period of last year.

The new import duties and monopoly surcharges that came into force last December together constitute a serious blow to the rice import trade. The reduction in the rate of drawback on the customs duty on husked rice imported into Poland for working up may also be mentioned in this connection.

France imports mainly milled rice. In 1932 its imports of whole milled rice, flour and semolina, chiefly from French Indo-China, increased by 33 per cent. and those of broken by 13 per cent. while those of rough rice, mainly from Italy, decreased by 10 per cent. In the first quarter of 1933 the total imports increased by 24 per cent; a large increase in those from the colonies outweighing a decrease of 30 per cent. in imports from foreign countries.

The Netherlands import of rough rice, which is mainly from Burma and Japan, decreased in 1932 by 51 per cent., while that of milled rice decreased by 47 per cent. Exports, which are very widely distributed, decreased by 10 per cent. in the case of rough rice, which goes mainly to Germany, and by 22 per cent. in that of milled rice, which is sent chiefly to Germany and the United Kingdom. In the first four months of 1933 imports of rough rice increased by 72 per cent. while those of milled, including broken, increased by 5 per cent.

Imports into the United Kingdom are almost entirely of milled rice, chiefly from Burma, Spain and the United States. That from Burma is generally re-milled, however; there is a large import of broken from this source. In 1932 there was a further increase of 2 per cent. in the total imports, those from British India (mainly Burma), increased by 13 per cent. but those from Spain and the United States decreased by 9 per cent. and 12 per cent. respectively. In the first five months of 1933 there was a decrease of 12 per cent. in the total imports, of 64 per cent. in those from the United States and of 96 per cent. in those from Spain, while those from British India increased by 32 per cent. The great falling off in foreign imports in the current year is due to the coming into force on 1st January, 1933 of a duty of 1d. per lb. on foreign whole milled and cargo rice. Only the superior quality of certain foreign rices enables them to retain part of the market.

The General Outlook.

World production appears to have undergone a further decrease in 1932 - 33. The variation with respect to the previous year in the individual regions of production has, however, been in general the reverse of that in 1931 - 32. Production in 1932 - 33 in the three major exporting countries, Burma, French Indo-China and Siam, taken together increased, due mainly to the fact that weather during the season was on the whole more favourable in these countries than in 1931 - 32, when climatic conditions were bad.

In Japan and its dependencies production also increased, mainly as a consequence in Japan and Korea, too, of a reversal of climatic conditions with respect to those of 1931 - 32; in China also the bad climatic conditions of 1931 - 32 appear to have been succeeded in the past season by unusually favourable conditions. In India proper, on the other hand, the rainfall conditions were unsatisfactory in several important areas so that the heavy crop of 1931 - 32 was followed by a deficitary crop in 1932 - 33. In Java and probably in other importing countries of the second rank there were larger crops due in great part to increase in area under the influence of the depression in export crops and the efforts of the Governments concerned to stimulate domestic food production.

Amongst the major exporting countries only Burma, therefore, with its strong position in the Indian market, finds itself this year in a more favourable situation. Its new preferential advantage in the United Kingdom is largely offset by a deterioration of the position in continental markets. In China and the Far Eastern market generally the position has, from the point of view of the exporting countries seriously deteriorated; given the above-mentioned position of Burma, however, this will react most severely on French Indo-China and Siam, which normally, and especially in the latter case, market the great bulk of their surplus in the Far East.

As regards the trade in high-quality rices the general conditions of depression in purchasing-power and of increased taxes on the product in European markets lead to the expectation of still more acute competition amongst exporters of these qualities.

Review.

The Empire Journal of Experimental Agriculture, Vol. I No. 2

July, 1932, pp. 98-192.

The second number of the latest addition to agricultural publications has recently come to hand, namely, Vol. 1 No. 2 of the Empire Journal of Experimental Agriculture, the first number of which made its appearance in April.

Much discussion has arisen with regard to the necessity for such a publication in view of the large number of journals of a similar character already in existence.

The necessity for and success of such a new organ of agricultural science must be judged by the ability of the publication committee to fill, and keep filled, the pages with matter of sound scientific agricultural interest and of high technical standard.

From this second number it would appear that such conditions are being fulfilled. This number deals with items as diverse as inheritance of wool characters in sheep and the statistical analysis of incomplete field results.

The first article by Dr. B. A. Keen is descriptive of experimental work carried out at Rothamsted on comparative tests of rotary cultivation and ridge ploughing and, although such comparative tests are not largely applicable in Malaya, they are of interest as suggesting contrasts between deep changkolling and ploughing.

The second paper is a short symposium by Dr. F. Hardy on tropical red soils in which properties of such soils from India, West Indies, South America and South Africa are compared.

The third paper by K. T. Hartly and M. Greenwood is on the effect of applications of small amounts of farmyard manure to cereal (guinea corn) crops in Nigeria. Their results on the whole appear somewhat inconclusive as shewn in the summary. It was found, as has been found locally, that farmyard manure increased the crop to a larger extent than an equivalent of artificials though, in this case, the results do not appear comparable, no "completes" being tried. The results of nitrogen trials appear inconclusive.

The paper by Martin G. Jones and J. O. Thomas on the effect of stock grazing on grassland ecology, although consisting of observations in a temperate climate, is of interest to any country which offers possibilities of sheep or cattle raising. Their main conclusions are that while nitrogenous manures nearly doubled the actual fodder yield it was without influence on the botanical composition. On the other hand, time and intensity of grazing markedly affected the botanical composition both in proportion of grass to clovers (in this experiment) and in the inroad of weeds.

The fifth paper by F. Yates on the statistical analysis of replicated experiments, when field results are incomplete, appears to have arisen owing to the work of Allan and Wishart who established formulæ for the estimation of a

single missing plot. As the author points out the method of the latter becomes involved when applied to more than one missing plot. The method of Yates is that of minimising the error variance obtained when unknowns are substituted for the missing yields. In practice this consists in the application of a first and second approximation to the missing plots.

A paper on silage by Arthuri I. Vestanan is chiefly of interest to dairy farmers, being descriptive of methods of preserving fodder as close to fresh conditions as possible.

A. Reifensberg and E. K. Ewborik continue their paper on soil profiles of Cyprus in this number. The first paper was descriptive of soils from limestone and serpentine. This second paper deals with weathering of other igneous rocks, diabase gabbro-norite and pillow lava.

The last two papers are devoted to sheep. One of these by J. A. S. Watson, D. Shilbeck and J. C. B. Ellis is on the food consumption of fattening sheep. The other is a general review of inheritance of wool characters in sheep by William C. Miller of the Institute of Animal Genetics, Edinburgh.

As a criticism a point which might be stressed is the immense utility of a summary and conclusions for all papers descriptive of original work. Such summaries enable the general reader immediately to ascertain whether the article in question is of interest or intelligible, while the specialist can quickly estimate the value of a given article to his own particular work.

J. H. D.

Departmental.

FROM THE DISTRICTS.

The Weather.

The usual cool wet weather characteristic of November was experienced generally throughout the Peninsula. Rainfall was up to the average in the North and South, being above the average in parts of Kedah. In the central belt of the Peninsula, however, stretching from the south of Perak to the north of Johore and from the west coast across to Temerloh and Pekan districts of Pahang the precipitation was in varying degrees below the average for the month.

Remarks on Crops.

Rubber.—The average price of rubber showed a slight rise probably caused by the improved prospect of introducing restriction. The highest and lowest prices in dollars and cents per picul recorded during the month for rubber from small holdings were:—Smoked Sheet \$9—\$18; Unsmoked Sheet \$7.50—\$17; Scrap \$1.80—\$7.10; Slab \$3.50—\$8.50. The average Singapore prices recorded for small-holders' rubber were:—Smoked Sheet \$16.50; Unsmoked Sheet \$15; Scrap \$5 as compared with \$15.50, \$14.50 and \$5 in October. The Penang prices for Unsmoked Sheet ranged from \$12—\$14.20 as compared with \$12.60—\$14.40 in October.

The number of small holdings tapped in all parts of the Peninsula showed a further increase during the month. Tapping systems were often severe with resultant damage to the bark. Mention was again made of the use of ladders in tapping, more especially in the Negri Sembilan. Rain interfered with morning tapping everywhere and reduced yields. In Kelantan it practically put a stop to all tapping. In some areas the effect of morning rain was avoided by afternoon tapping; in Johore tapping before daybreak was resorted to in some localities.

During the prevailing wet weather Mouldy Rot disease was much in evidence. In some districts its control is receiving more attention from small-holders and the use of approved disinfectants is extending, more especially in Kedah, Selangor, Western Pahang and parts of the Negri Sembilan.

From Kelantan it is reported that although hand rollers have been offered to Societies and individuals on very easy terms, local belief in the advantage of selling a large weight of rubber, however wet and dirty, rather than good sheet has proved difficult to overcome. One small-holder has, however, taken delivery of rollers and has produced greatly improved rubber and now wants to purchase latex from his neighbours. This man is receiving further instruction in the preparation of good rubber.

The number of Malay owned smoke houses in the Kuala Langat district of Selangor is increasing and the quality of rubber produced is improving. One

Malay, who already deals in copra, has undertaken to buy this rubber and sell it direct to the exporting agents.

Padi.—The price of padi at the Government Rice Mill, Bagan Serai, was \$1.62 per picul, a fall of 8 cents per picul as compared with the price in October. There was a similar slight decrease in the price in Kedah towards the end of the month, but in Province Wellesley the price improved to \$7 per 100 gantangs. Elsewhere there were slight rises of price in some areas, the range being 5 to 13 cents per gantang.

Planting was practically completed throughout the Peninsula by the end of the month, the wet weather having favoured transplanting in areas such as Kuala Selangor district where work had been delayed by drought. Crop prospects continued to be good in Kedah, Province Wellesley, Krian, Malacca and parts of Pahang.

Harvesting has commenced in the Jelebu district of Negri Sembilan and in some of the riverine areas in Pahang. In the latter States it is now expected that the crop will be reaped before serious damage by floods is likely to occur. In some districts of Johore harvesting has been completed, in others it is in progress, while in some planting has only just been completed. Rats, birds and stem-borers have caused extensive losses of grain and reduced what should have been a good crop to moderate proportions. The conditions under which padi is grown in many parts of Johore render the control of these pests extremely difficult.

In Selangor the short term padis have given very satisfactory yields ranging from 200—450 gantangs per acre. The indications are that, if the planting of two crops a year were given a fair trial by the growers, it would prove a success in these areas.

Coconuts and Copra.—The price of copra again declined slightly, averaging \$2.50 per picul in Singapore. The price range in Penang was \$2.13—\$3.20, and elsewhere it was \$1.70 to \$3.20.

Although the price of copra is discouraging, progress in the erection of approved kilns is recorded from Province Wellesley, Krian and Kelantan. In Selangor copra production by Malays has continued steadily, though in Kuala Selangor district padi planting has caused the suspension of manufacture on some kilns, and in Temerloh district padi harvest has temporarily reduced the number of nuts collected, although a new kiln has been completed at Kertau.

On the west coast of Johore the sale price of fresh nuts exceeds their value as copra. In that State, as also in Selangor and Malacca, the production of home-made coconut oil is increasing.

A course in the preparation and marketing of improved copra was held in Selangor from November 21st to December 2nd for 8 Malay Agricultural Officers and 6 Penghulus from Johore and 2 Malay Agricultural Assistants from Malacca. All officers showed a keen interest in this work and appeared

to have acquired a sound knowledge of the subject when examined orally at the end of the course.

Fruit.—In Perak, Selangor and Singapore Island the second crop of durians and mangosteens began to appear on the markets, while in Central Perak langsats and rambutans were approaching maturity. The crop in Singapore was small and the local fruit crop in eastern Pahang was reported to be poor.

Pineapples.—Harvesting of the second main crop proceeded during the month. One factory was operating in Selangor, five in Johore and three in Singapore. Prices for fruit paid by the factories showed a considerable improvement, more especially in Johore and Singapore. First quality fruit in Johore fetched \$2 to \$2.50 per 100 and second quality \$1.50 to \$1.80, while the corresponding prices in Singapore were \$2.50 and \$1.25 per 100 fruits.

On two large areas in Johore where pineapples are grown as a sole crop, good growth has been observed.

Tobacco.—Interest in the cultivation of this crop has on the whole been well maintained. Prices for first quality dried leaf have varied considerably in different areas, ranging for the most part from \$17 to \$45 per picul. In Johore, however, prices for leaf of good quality were as high as \$60 per picul.

In Singapore Island several growers are attempting to produce Virginian cigarette tobacco from seeds supplied by this Department. Prices for cigar leaf ranged from \$35 to \$70 per picul and bright cigarette leaf of good quality will realise \$80 per picul.

Agricultural Stations.

At all Stations good progress during favourable weather conditions was made with planting and supplying programmes and the pruning of one year old tea bushes. The budded citrus trees imported about a year ago from South Africa have grown well, especially at Bukit Mertajam, Kuala Kangsar, Cheras and the Pineapple Experiment Station in Singapore.

At the Agricultural Experiment Station, Tanah Rata, the crop of Arabian coffee was harvested and samples are being prepared for despatch to London with a view to obtaining a report on quality and a valuation. Fifteen species of fodder grasses from England were received and were being planted, so that there is now quite a large collection of such grasses under trial. A collection of different varieties of several kinds of vegetables from England, Australia and India is also being made.

Two pure-bred Light Sussex cockerels and four pure-bred pullets were received at the Sungei Udang Station in Malacca from England.

A party of Penghulus and Ketuas from surrounding mukims, accompanied by the District Officer and Deputy Assistant District Officer, Krian, numbering 118 persons in all, visited the Titi Serong Padi Station on the 9th November.

The Principal Agricultural Officer, Johore, and also the Malay Agricultural

Assistant, Segamat, with a party of Penghulus from his district visited the Pulau Gadong Padi Station in Malacca.

Padi Test Plots.

Planting was practically completed at the Padi Test Station, Panchang Bedina, and the Haji Durani Test Plot in Kuala Selangor district. Planting on the Sungei Blat Test Plot in Kuantan district of Pahang was well advanced.

A second bed of padi straw for the cultivation of the mushroom *Volvaria volvaceae* was established at the Bukit Merah Padi Test Station and yielded well early in the month. On November 29th a demonstration of mushroom growing was given to a party of Penghulus at this Station. A similar bed has been made at the Kuang Padi Test Station in Selangor. Spawn for trial has been sent from Province Wellesley to the Agricultural Officers in Pahang and North Johore.

Weekly Fairs.

In a recent report by the Chairman of the Weekly Fairs Committee in Kedah it is estimated that 18,000 buyers and sellers attend the 39 fairs each week and that the average value of the sales made per fair is \$250 per week.

The Assistant Principal Agricultural Officer, Kedah, gave a demonstration at one fair of the construction of frame bee-hives and the care of the local bee (*Apis indica*).

School Gardens.

The annual inspection of gardens in Larut and Matang District for the award of the District Shield was carried out during the month. The shield was won by Matang School with Changkat Jering School a close second. Judging of gardens in Perak South and Pahang was commenced. In the latter State some very good gardens were seen, showing a marked improvement during the last few years. In Johore judging for the annual competition took place between November 16 and 20th; with but few exceptions the standard attained was very satisfactory, particularly as all the gardens have only been established for a comparatively short period.

Home Gardens Competitions.

Judging in the home garden competition in Tapah mukim was completed, there being 20 gardens to inspect. In the Negri Sembilan judging in this competition was commenced. It is reported that some of the gardens were very creditable and that much real enthusiasm existed among the majority of exhibitors. In the Pahang competition results generally were poor, but some very creditable gardens were seen in Mukim Chenor of Temerloh district and Mukim Semantan Ulu of Raub district. In Selangor all competitions for the year have been completed. They have done much to foster interest in this work and a large number of those who opened gardens solely for the purpose of the

competition have continued to cultivate them, since they have discovered what an asset a vegetable garden can be in assisting the family budget.

Carp Rearing.

Many Chinese vegetable gardeners and land owners rear four species of carp in old mining pools or artificially made fish ponds, but up to the present few Malays have shown any interest in this minor industry. Some twelve months ago, however, a Malay at Budu in Pahang obtained carp fry from the Fisheries Department in Singapore and stocked a pond on his land. In November he made the first sale of fish at the local weekly fair. The fish were about one year old, weighed between $3\frac{1}{2}$ and 4 katis each and realised 25 cents per kati. This was quite a good price, since in Selangor the fish reared by Chinese are retailed for 13 to 24 cents per kati according to the variety. It appears, therefore, that carp rearing in parts of Pahang where the supply of fish is strictly limited would be a profitable undertaking for any Malay who has, or can easily construct, a suitable pond.

DEPARTMENTAL NOTES.

Visits and Tours.

The Director of Agriculture, Dr. H. A. Tempany, C.B.E., paid an official visit to the State of Negri Sembilan from November 7th to November 9th. During his visit he inspected the Agricultural Stations and Padi Test Plots in the State and discussed matters relating to agricultural policy with the Hon'ble the British Resident and the Agricultural Field Officer.

On November 21st the Director visited Singapore and attended a Conference, with representatives of the Singapore Chamber of Commerce, regarding projected legislation in connection with the pineapple industry. On November 22nd he gave evidence before the Straits Settlements Trade Commission and, in addition, visited and inspected the Pineapple Station at Lim Chu Kang and discussed agricultural problems with the Hon'ble the Colonial Secretary and the Agricultural Field Officer.

Agricultural Advisory Committee.

A meeting of the Agricultural Advisory Committee was held at the Head Office of the Department of Agriculture on November 16th—17th. On the first day the Committee paid an official visit to the Experimental Plantation, Serdang, and inspected the various lines of experimental work in progress.

At the meeting held on the 17th November, the following matters were discussed:—distribution of disinfectants to small-holders for control of mouldy-rot disease of rubber trees; home gardens competitions; poultry; the Malayan padi competition; importation of palm oil into U.S.A.; Copra; projected legislation re the pineapple canning industry in Malaya; farm schools at Agricultural Stations in Malacca and Singapore; shipment of bananas from Malaya to other countries; development of the rice industry in Malaya.

The meeting was informed of the resignation of Mr. C. B. Towill from the Committee and recorded its regret thereat. It was mentioned that it is proposed to nominate Mr. G. Teale of Messrs. Cumberbatch & Co., Ltd., as Mr. Towill's successor.

School of Agriculture, Malaya.

Enquiries have been received from various sources as to the possibility of recruiting students from the school for employment locally, the prospects offered being, in the majority of cases, very attractive. This interest is definitely encouraging, particularly as there is evidence that it will expand.

A special course of instruction in bud-grafting of rubber was held during October and November 1933. Instruction was given by one of the Malay conductors of the Rubber Research Institute, by arrangement with the Director of the Institute.

An outbreak of eye-worms in the poultry at the School, as well as intestinal round-worms and some other troubles, gave opportunities for practical instruction in poultry diseases.

Changes in Accommodation at the Head Office, Kuala Lumpur.

The laboratory of the Government Entomologist has been moved to the bungalow, No. 607 Swettenham Road, about a quarter of a mile from the Department. The clerical staff now occupies the former Entomological laboratory. The office of the Director will in future be situated in the room immediately above the Chemical laboratory, and the Chief Field Officer will occupy the adjoining room. The room formerly occupied by the Chief Field Officer has been allotted to the Soils Division.

The Chief Research Officer and the Personal Assistant to the Director share the Director's former office.

MALAYAN AGRICULTURAL EXPORTS, OCTOBER, 1933.

PRODUCT.	NET EXPORT IN TONS.				
	Year 1932	Jan.-Oct. 1932	Jan.-Oct. 1933	Oct. 1932	Oct. 1933
Arecanuts ...	20,280	16,121	17,733	680	2,803
Coconuts, fresh† ...	108,123	100,607	86,401	10,637	7,947
Coconut oil ...	11,932	9,212	14,713	1,080	1,665
Copra ...	97,464	78,147	86,765	12,196	13,728
Gambier, all kinds ...	2,925	2,546	2,027	142	225
Palm kernels ...	1,248	973	1,713	130	280
Palm oil ...	7,892	6,290	9,247	892	2,129
Pineapples, canned ...	66,291	56,703	51,271	2,239	1,553
Rubber § ...	417,137	342,132	372,787‡	36,621	41,409
Sago,— flour ...	10,267	7,478	3,787	916	1,182
" — pearl ...	3,128	2,716	1,917	580	273
" — raw ...	4,148*	3,330*	3,482*	302*	412*
Tapioca,— flake ...	9,028	7,846	8,691	653	741
" — flour ...	392	112*	182*	79	13
" — pearl ...	19,977	16,564	14,568	1,193	1,636
Tuba root ...	165‡	105‡	399‡	7‡	56

† hundred in number.

§ production.

* net imports.

‡ subject to amendment monthly.

Statistical.

MARKET PRICES

November 1933.

Rubber.—The price of rubber has remained fairly steady during the month, opening at 12½ cents per lb. for Spot loose in Singapore and closing at 13½ cents per lb. The average price for the month was 13½ cents per lb. in Singapore, 4 3/32 pence in London and 8½ cents Gold in New York as compared with 12 15/16 cents, 3 31/32 pence and 7 9/16 cents Gold respectively in October.

Palm Oil.—The course of the market Liverpool/Continent during November on a basis of 5 per cent. f.f.a., c.i.f. was as follows:—November 2nd £16.0.0 per ton net, November 9th £15.10.0 per ton net, November 16th £15.0.0 per ton net and November 23rd £15.5.0 per ton net.

Prices in the U.S.A. landed weight per pound in bulk c.i.f. New York/Philadelphia were 2.70 cents Gold on the 2nd November, 2.70 cents Gold on the 9th November; 2.75 cents Gold on the 16th November; and 3 cents Gold on the 23rd November.

The price of palm kernels Fair Average Malayan Quality c.i.f. landed weight on the Continent was Shillings 7/9 per cwt. on November 2nd; Shillings 7/7½ per cwt. on the 9th November; Shillings 7/7½ per cwt. on November 16th; and Shillings 7/6 per cwt. on the 23rd November.

Copra.—Prices secured during November were similar to October prices, the highest Singapore price for Sundried during November was \$3.40 per picul, and the lowest price \$3.10 per picul. The average price per picul being \$3.21 as compared with \$3.20 during October.

The mixed quality averaged \$2.52 per picul as compared with \$2.60 per picul in October.

Coffee.—The price at Singapore for Sourabaya coffee continued steady, prices ranged according to grade, from \$16 to \$18 being similar to prices obtained during October. Palembang coffee averaged \$12.31 during the month being quoted at \$12 on the 3rd and \$12.25 on the 24th; the average figure for October was \$12.56.

Arecanuts.—Palembangs averaged \$1.98 and Bila Whole \$2 per picul as compared with \$1.85 and \$2 respectively during October. The range of Singapore prices for other grades was:—Split \$2.50 to \$4; Red Whole \$3 to \$4.50; Sliced \$5 to \$7.50 and Kelantan \$3 to \$3.50.

Gambier.—There was a further fall in the price of Block Gambier during November, the average price being \$4 per picul, Cube No. 1 averaged \$7.25. Corresponding figures for October were \$4.33 and \$7.50 respectively.

Pineapples.—Values decreased again during November, the average Singapore price per case being as follows:—Cubes \$3.02, Sliced Flat \$2.94 and Sliced Tall \$3.07 as compared with \$3.15, \$3.08 and \$3.20 respectively during October.

Tapioca.—The price of Flake Fair averaged \$4.06 as compared with \$4.41 in October. Pearl Seed averaged \$5.17 a slight decrease on the October price of \$5.26, and Pearl Medium averaged \$5.50, the average price being \$5.46 in the previous month.

Sago.—Pearl—Small Fair again declined in price, averaging \$3.65 during the month; the price was \$3.81 in October. Flour-Sarawak Fair averaged \$1.80½ as compared with \$1.72½ in October.

Mace.—Prices ruling during the month were nominal and similar to October prices, namely \$70 per picul for Siouw and \$50 per picul for Amboina.

Nutmegs.—Prices remained steady in November, Singapore price per picul for 110's was \$19 and 80's averaged \$25. Similar prices ruled during October.

Pepper.—Average Singapore prices during November were as follows:—Singapore Black, \$13 per picul; Singapore White \$22.25 and Muntok White \$22.87; the corresponding figures for October were \$12.83, \$22.41 and \$22.87 respectively.

Cloves.—As in the previous months, the demand for cloves remained small, nominal prices being \$40 for Zanzibar and \$45 per picul for Amboina.

The above prices are based on London and Singapore daily quotations for rubber; on the Singapore Chamber of Commerce Weekly Reports for the month and on other local sources of information. Palm oil reports are kindly supplied by Messrs. Guthrie & Co., Ltd., Kuala Lumpur, and the Singapore prices for coffee and arecanuts by the Lianqui Trading Company of Singapore.

1 picul = 133½ lbs. The Dollar is fixed at two shillings and four pence.

Note.—The Department of Agriculture will be pleased to assist planters in finding a market for agricultural produce. Similar assistance is also offered by the Malayan Information Agency, 57, Charing Cross, London, S.W.1.

GENERAL RICE SUMMARY.*

October 1933.

Malaya.—Gross foreign imports of rice (including stocks available for re-export) during October, 1933 amounted to 42,110 tons, as compared with 46,332 tons in October, 1932 of which 52 per cent. were consigned to Singapore, 17 per cent. to Penang, 7 per cent. to Malacca, 16 per cent. to the Federated Malay States and 8 per cent. to the Unfederated Malay States.

Of these imports, 67 per cent. were from Siam, 31 per cent. from Burma, 1 per cent. from Indo-China and 1 per cent. from other countries.

Total foreign exports of rice from Malaya in October, 1933, were 13,675 tons (including 242 tons local production) as compared with 17,486 tons in October 1932.

Of these exports 75 per cent. were consigned to Netherlands India and 25 per cent. to other countries.

Net imports for the period January to October 1933, were 357,981 tons as compared with 335,184 tons during the same period for 1932, an increase of 6.8 per cent.

India and Burma.—Total foreign exports of rice during September 1933, were 99,000 tons as compared with 159,000 tons in the previous month and 144,000 tons in September 1932, a decrease of 38 per cent. in respect of the previous month and a decrease of 32 per cent. in respect of the same period in the previous year.

Total exports during the period January to September 1933, were 1,564,000 tons as compared with 1,794,000 tons for the corresponding period of 1932, a decrease of 13 per cent.

Total exports of rice and bran from Burma during the period 1st January to 30th September amounted to 2,759,983 as compared with 2,597,096 tons in the corresponding period of 1932, an increase of 6.3 per cent.

Japan.—Restriction of Imports of Rice. Article 3 of an Imperial Ordinance which was promulgated at Tokio in the Official Gazette on October 13th, 1933, reads as follows:—"Rice may not be imported or exported without the permission of the Government except in cases provided for by Imperial Ordinance."

The Ordinance which was to take effect from 1st November, 1933, has been passed with a view to control the supply and price of rice which continues to cause the Government of Japan much anxiety. The countries, whose trade will be chiefly affected by the new restrictions on the import of rice, will be Siam, which provided 76 per cent. of the total foreign imports in 1932, and United States of America.

Formosa.—Area under padi (second crop in acres) in 1933 is 960,760, the area in the corresponding period of 1932 was 941,108, an increase of 2 per cent.

*Abridged from the Rice Summary for October 1933, compiled by the Department of Statistics, S.S. and F.M.S.

The estimated production for 1933 is 645,263 tons being a decrease of 3 per cent. as compared to that of last year.

Siam.—Exports (approximate) during October 1933, amounted to 127,506 tons as compared with 129,769 tons in October 1932, a decrease of 2 per cent.

Netherlands India, Java and Madura.—For the period end of September 1933, the area harvested amounted to 8,529,000 acres an increase of 94,000 acres or 1 per cent. as compared with the corresponding period of 1932: the area damaged was 429,000 acres an increase of 85,000 acres or 25 per cent. as compared with 1932, and additional plantings awaiting harvesting amounted to 1,092,000 acres an increase of 72,000 acres or 7 per cent. The total acreage at the end of September 1933 amounted to 10,050,000 acres, an increase of 251,000 acres or 2 per cent. as compared with the same period in 1932.

Imports of rice into Java and Madura during January to August 1933 totalled 104,200 tons, a decrease of 5,910 tons or 3 per cent. as compared with the same period of 1932.

Imports of rice into the Outer Provinces during January to August 1933 amounted to 172,244 tons, an increase of 4,763 tons or 3 per cent. as compared with the same period of 1932.

French Indo-China.—Entries of padi at the port of Cholon from January to October 1933 amounted to 981,000 metric tons, an increase of 12,000 tons or 1 per cent. as compared with the same period of 1932.

Exports of rice from Saigon for the period January to October 1933 totalled 1,091,000 tons, an increase of 102,000 tons or 10 per cent. as compared with the corresponding period of 1932.

Ceylon.—Imports for the period January to September 1933, totalled 324,331 tons, a decrease of 12,692 tons on the imports for the same period of 1932.

Of these imports 19 per cent. were from British India, 10 per cent. from other countries.

Europe and America.—Quantities of rice shipped from the East were:—

- (a) To Europe for the period January 1st to October 19th, 1,113,183 tons, an increase of 249,846 tons or 29 per cent. as compared with the same period of 1932. Of these shipments 49 per cent. were from Burma, 2 per cent. from Japan, 41 per cent. from Saigon, 7 per cent. from Siam and 1 per cent. from Bengal, as compared with 55 per cent. from Burma, 3 per cent. from Japan, 35 per cent. from Saigon, 4 per cent. from Siam and 3 per cent. from Bengal in 1932.
- (b) To the Levant, period January 1st to September 30th, 1933, 28,904 tons, a fall of 16,419 tons or 36 per cent. as compared with the same period of 1932.
- (c) To America and the West Indies for the period January 1st to September 21st, 1933, an increase of 32,259 tons or 32 per cent. as compared with the same period of 1932.

MALAYA RUBBER STATISTICS

ACREAGES OF TAPPABLE RUBBER NOT TAPPED ON ESTATES OF 100 ACRES AND OVER, FOR THE MONTH ENDING OCTOBER, 1933.

STATE OR TERRITORY	Acreage of Tappable Rubber end 1932	ESTATES WHICH HAVE ENTIRELY CEASED TAPPING				ESTATES WHICH HAVE PARTLY CEASED TAPPING				Total (3) + (5)	Percentage of (7) to (2)
		Percentage of		Percentage of		Percentage of		Percentage of			
		Acreage (3)	(3) to (2) (4)	Acreage (5)	(5) to (2) (6)	Acreage (7)	(7) to (2) (8)				
STRAITS SETTLEMENTS :—											
Province Wellesley	44,734	1,447	3.2	8,376	18.7	9,823	21.9				
Dindings	6,969	209	3.0	900	12.9	1,109	15.9				
Malacca	111,780	4,995	4.5	17,662	15.8	22,657	20.3				
Penang Island	1,635	626	38.3	260	15.9	886	54.2				
Singapore Island	28,269	9,730	34.4	5,264	18.6	14,994	53.0				
Total S.S.	193,387	17,007	8.8	32,462	16.8	49,469	25.6				
FEDERATED MALAY STATES :—											
Perak	250,951	7,543	3.0	35,657	14.2	43,200	17.2				
Selangor	308,379	8,335	2.7	41,181	13.3	49,516	16.0				
Negeri Sembilan	228,541	7,342	3.2	21,544	9.4	28,886	12.6				
Pahang	38,141	6,142	16.1	5,619	14.7	11,761	30.8				
Total F.M.S.	826,012	29,362	3.5	104,001	12.6	133,363	16.1				
UNFEDERATED MALAY STATES :—											
Johore	325,747	21,365	7.5	33,626	10.3	57,991	17.8				
Kedah (a)	114,551	5,254	4.6	8,984	7.8	14,238	12.4				
Kelantan	21,175	7,840	37.0	2,303	10.9	10,143	47.9				
Trengganu (b)	4,352	Nil	Nil	2,072	47.6	2,072	47.6				
Perlis (a)	957	177	18.5	468	48.9	645	67.4				
Total U.M.S.	466,782	37,636	8.1	47,453	10.1	85,089	18.2				
TOTAL MALAYA	1,486,181	84,005	5.6	183,916	12.4	267,921	18.0				

Notes :— (a) Registered companies only and are rendered quarterly.

(b) Registered companies only.

The above table together with a Summary, was prepared and published by the Statistics Department, S.S. and F.M.S. in November, 1933.

MALAYA RUBBER STATISTICS
TABLE I
STOCKS, PRODUCTION, IMPORTS AND EXPORTS OF RUBBER, INCLUDING LATEX, CONCENTRATED LATEX AND REVERTEX,
FOR THE MONTH OF OCTOBER 1933 IN DRY TONS.

Territory	Stocks at beginning of month 1		Production by estates of less than 100 acres and over		Production by estates of less than 100 acres estimated 2		Imports		Exports including re-exports		Stocks at end of month	
	Dealers	Ports	Estates acres and over	during the month	January to October 1933	January to October 1933	during the month	January to October 1933	during the month	January to October 1933	Dealers	Ports
	2	3	4	5	6	7	8	9	10	11	12	13
MALAY STATES:—												
Federated Malay States	13,084	11,520	12,041	112,263	10,093	89,726	Nil	Nil	18,563	2,531
Johore	3,158	2,742	3,956	35,087	4,300	43,373	Nil	4	1,758	6,346
Kedah	437	2,134	2,685	23,655	1,503	13,560	Nil	119	1,422	2,779
Perlis	13	84	27	135	Nil	Nil	Nil	37	Nil
Kelantan	323	225	223	1,829	859	5,371	Nil	923	105	1,067
Trengganu	55	50	182	1,368	91	683	Nil	Nil	273	Nil
Total Malay States	17,068	16,683	19,100	175,186	16,876	152,846	175	4	21,848	13,033
STRAITS SETTLEMENTS:—												
Malacca	3,455	1,256	1,481	13,287	...	...	3	14	5,505	...
Province Wellesley	1,151	761	568	5,186	...	...	Nil	Nil	...	...
Dindings	47	170	104	992	3,110	23,742	Nil	13,122	7,484	...
Penang	1,571	5,511	12	8	1,583	11,621	1,583	7,881	...	...
Singapore	9,536	30,185	134	1,497	...	...	90,278	...	...	...
Total Straits Settlements	11,107	40,349	2,323	21,011	3,110	23,742	13,207	13,122	80,173	150,649
Total MALAYA	11,107	57,417	19,015	21,423	196,197	19,986	176,590	13,382	13,126	99,096	159,268	61,002

TABLE II
DEALERS' STOCKS, IN DRY TONS

Class of Rubber	Federated Malay States		S'pore		Penang		Province Wellesley		Johore		Kedah	
	21	22	23	24	25	26	27	28	29	30	31	32
DRY RUBBER	10,104	25,822	4,805	4,110	1,393	156	...	...	...	...	...	...
WET RUBBER	8,512	4,618	722	179	1,607	281	...	...	...	...	...	...
TOTAL	18,616	30,440	5,527	4,289	3,000	437	...	...	...	...	...	...

TABLE III
FOREIGN EXPORTS

Exports	Singapore		Penang		Port Swettenham		Malacca		MALAYA	
	January to October 1933	For month 1933	January to October 1933	For month 1933	January to October 1933	For month 1933	January to October 1933	For month 1933	January to October 1933	For month 1933
...	40,956	284,683	12,975	104,698	7,235	61,933	1,186	10,050	61,002	461,734
...

TABLE IV
DOMESTIC EXPORTS

Exports	Singapore		Penang		Port Swettenham		Malacca		MALAYA	
	January to October 1933	For month 1933	January to October 1933	For month 1933	January to October 1933	For month 1933	January to October 1933	For month 1933	January to October 1933	For month 1933
...	40,956	284,683	12,975	104,698	7,235	61,933	1,186	10,050	61,002	461,734
...

Notes:—1. Stocks on estates of less than 100 acres and stocks in transit on rail, road or local steamer are not ascertained.

2. The production of estates of less than 100 acres is estimated from the formula: Production + Imports + Stocks at beginning of month = Exports + Stocks at end of month + Consumption. i.e., Column (7) = Column (13) + (14) + (17) + (18) + (19) + 14 tons local consumption during the month—[13]—[14]—[15]—[16]—[17]. For the Straits Settlements, Columns (9) and (10) represent purchases by dealers from local estates of less than 100 acres, reduced by 13.2 tons of dry rubber.

3. Dealers' stocks in the Federated Malay States are reduced to dry weights by the following fixed ratios: unsmoked sheet, 15; wet sheet, 25; scrap, lump, etc., 40. Stocks elsewhere are in dry weights as reported by the dealers themselves.

4. Domestic exports are estimated by deducting the average monthly dry weight of foreign imports over a period of 2 months from the gross foreign exports of the last month. The foreign exports of the Malay States, being domestic production.

5. The above, with certain omissions, is the Report published by the Registrar-General of Statistics, S.S. and F.M.S., at Singapore on 22nd November

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